

20029-H110-R0-00

CR - 128588

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PROJECT TECHNICAL REPORT  
TASK E&DD-702C

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TRW VORTEX-LATTICE METHOD SUBSONIC AERODYNAMIC  
ANALYSIS FOR MULTIPLE-LIFTING-SURFACES (N. SURFACE)  
TRW PROGRAM NUMBER HA010B

NAS 9-12330

1 SEPTEMBER 1972

Prepared for  
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
MANNED SPACECRAFT CENTER  
HOUSTON, TEXAS

Prepared by  
Applied Mechanics Department



(NASA-GR-128588) TRW VORTEX-LATTICE METHOD  
SUBSONIC AERODYNAMIC ANALYSIS FOR  
MULTIPLE-LIFTING-SURFACES (N. SURFACE) TRW  
PROGRAM NUMBER HA010B (TRW Systems) 266 p  
HC \$8.50

CSCL 01A G3/02

Unclassified  
14388

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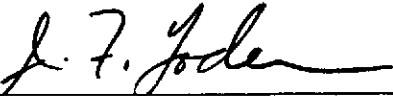
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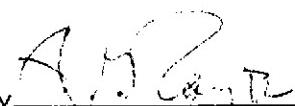
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#### ACKNOWLEDGMENTS

This report was prepared by the TRW Systems Group, Houston, Texas under NASA Manned Spacecraft Center Contract NAS 9-12330. The sponsor of the present investigation was the Aerodynamics and Entry Technology Section, Engineering Analysis Division, Manned Spacecraft Center, National Aeronautics and Space Administration, Houston, Texas. Mr. James C. Young was the NASA/MSC Technical Monitor. The author and originator of the TRW Vortex-Lattice Analysis Program is Mr. Antulio V. Gomez of TRW. Credit is also due to Mr. John F. Yoder of TRW and Messrs. Paul O. Romere and Ralph E. Graham of NASA/MSC who contributed to the formulation of the program qualification test study. Also, the author wishes to thank Mrs. Juanice O'Connor of TRW who assisted in the final preparation of this report.

## ABSTRACT

This manual provides a condensed users description and theory for TRW's Vortex-Lattice Method Subsonic Aerodynamic Analysis for Multiple-Lifting-Surfaces (N. Surface) Program HA010B. The program is designed to provide solutions of engineering accuracy for determining the aerodynamic loads on single- or multiple-lifting-surface configurations that represent vehicles in subsonic flight, e.g., wings, wing-tail, wing-canard, lifting bodies, etc. The manual describes the preparation of the input data, associated input arrangement, and the output format for the program data, including specification of the various operational details of the program such as array sizes, tape numbers utilized, and program dumps. As supplementary information, the manual includes a full description of the underlying theory used in the program development and a review of the program qualification tests.

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### LIST OF SYMBOLS<sup>†</sup>

AR	aspect ratio
b	span
B(X,Y,Z)	the first of two coordinate points that define the shape and location of a skew-shaped horseshoe vortex filament.
c	chord
$\bar{c}$	mean geometric chord (MGC), $\bar{c} = \frac{1}{S} \int_{-b/2}^{+b/2} c^2 dy$
$c_D$	wing drag coefficient
$c_d$	section drag coefficient
CF	aerodynamic cleanliness factor
$c_F$	force coefficient
$c_h$	section hinge moment coefficient
$c_L$	wing lift coefficient
$c_\ell$	section lift coefficient
$c_{\ell_{al}}$	additional section lift coefficient
$c_{\ell_b}$	basic section lift coefficient
$C_M$	wing moment coefficient
$c_m$	section moment coefficient
Cn	n = 1,2,3,..., constants
$C_N$	wing normal lift coefficient
$c_n$	section normal lift coefficient
$c_p$	pressure coefficient, $c_p = (p - p_\infty)/q_\infty$
$C_T$	wing thrust coefficient

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<sup>†</sup>Note: Symbols defined in the text may be omitted from this list.

LIST OF SYMBOLS (Continued)

$c_t$	section coefficient for thrust
$c_x$	force coefficient for X direction component
$c_x$	section coefficient for force acting in the X direction
$D(X,Y,Z)$	the second of two coordinate points that define the shape and location of a skew-shaped horseshoe vortex filament.
F	force
$F_n$	$n = 1, 2, 3, \dots$ , etc., constants
h	height above the ground plane
K	total number of elemental panels
L	lift
$\ell$	length increment
M	Mach number
$m$	lift slope
p	pressure
$P(X,Y,Z)$	coordinates of a field point for which the induced-velocity vector is calculated.
$q_\infty$	dynamic pressure, $q_\infty = 1/2 \rho_\infty V_\infty^2$
R	radius
r	distance from the origin
Re	Reynolds number
S	wing area
s	scale
$t_1$	elapsed time (seconds) measured from the start of the execution of the program
$t_2$	elapsed time (seconds) for the execution of the last case
$V_\infty$	free stream velocity
W	dummy span defined as the independent variable in the interpolation routine used to calculate the lifting-surfaces span dimensions (see Section 7.4[6]).

LIST OF SYMBOLS (Continued)

X	}	coordinate axes of a right-handed Cartesian coordinate system.
Y		
Z		
$\bar{X}$		X-Y-Z coordinates that locate the 1/4 chord of the mean geometric
$\bar{Y}$		chord (MGC) location in the general coordinate system.
$\bar{Z}$		
$\alpha$		wing angle of attack measured on the X-Z plane relative to the X-coordinate axis and the free stream velocity vector.
$\alpha R_0$		wing angle of attack for zero lift ( $C_L = 0$ )
$\beta$		Prandtl-Glauert compressibility factor, $\beta = \sqrt{1 - M_\infty^2}$
$\Gamma$		circulation strength of a vortex filament
$\delta$		increment of span
$\delta_f$		deflection of flap
$\delta_{LA}$		deflection of left aileron
$\delta_{RA}$		deflection of right aileron
$\delta_{tab}$		deflection of trim-tab
$\Delta$		determinant
$\Delta L$		increment in lift
$\Delta S$		increment in area
$\epsilon$		geometric twist (angle) of chord plane
$\Lambda$		sweepback angle
$\pi$		$\pi, \pi = 3.14159$ (as used in the program)
$\rho_\infty$		free stream density
$\phi$		dihedral angle
$\psi$		influence function coefficient
$\psi$		scalar part of the influence function coefficient
$\vec{1AB}$		unit vector defined by two field points A(X,Y,Z) and B(X,Y,Z).
$\vec{1N}$		unit vector normal to a surface
$\vec{1V}$		unit vector for the induced velocity

LIST OF SYMBOLS (Continued)

$\vec{l_x}$       }  
 $\vec{l_y}$       }  
 $\vec{l_z}$       } unit vectors parallel to the X, Y, Z, coordinate axes respectively.

SUBSCRIPTS:

CG	center of gravity
CP	center of pressure
C/4	one-quarter chord point location
e	elemental panel or lifting-surface designation
f	flap
g	ground
h	hinge
I	image
i	induced
L	lower surface
LA	left aileron
LE	leading edge
M	moment
P	pitching
R	root (geometry) or rolling (moment)
RA	right aileron
ref	reference dimensions
tab	trim-tab
TE	trailing-edge
U	upper surface
v	vortex-lift
Y	yawing

LIST OF SYMBOLS (Continued)

SUPERSCRIPTS:

- vector
- ' alternate

ABBREVIATIONS:

A.C.	aerodynamic center
C.G.	center of gravity
C.P.	center of pressure
L.E.	leading edge
MAC	mean aerodynamic chord
MGC	mean geometric chord
NCD	number of chord discontinuities
NCE	number of chord elements
NSE	number of span elements
T.E.	trailing edge

## 1.0 PROGRAM ABSTRACT

PROGRAM NUMBER: HA010B (N.SURFACE)  
PROGRAM TITLE: TRW Vortex-Lattice Method Subsonic Aerodynamic Analysis for Multiple-Lifting-Surfaces  
TAPE NUMBER: T00078 or A10202  
STATUS: Production  
LANGUAGE: Fortran V  
SYSTEM: UNIVAC 1108/CDC 6500 Computer  
CORE STORAGE REQUIREMENTS: Approximately 50K words  
TYPICAL EXECUTION TIME: 2 to 5 minutes per case (UNIVAC 1108)  
DESCRIPTION:

The aerodynamic airload distribution and spatially-integrated force and moment coefficients are calculated for single- or multiple-lifting-surface configuration by an improved vortex-lattice method developed by TRW. In this method, the influence of each surface is represented by a network of concentrated line vortices distributed on the surfaces and behind the surface-trailing-edges. The strength or circulation of these vortices is determined by the requirement that the flow be parallel to each surface at a discrete number of boundary control points or collocation points that is equal to the number of unknown vortex strengths. The treatment of the control point boundary conditions incorporated in the analysis (TRW's) is based on the exact surface geometry, i.e., no linearization or other usual simplifying assumptions are made. This feature makes it possible to perform more accurate calculations for general non-planar lifting surface configurations. The effect of the leading-edge flow separation on the airload coefficients for theoretically sharp leading-edges is evaluated by an approximate technique based on the vortex-lift leading-edge suction analogy. Numerical solutions can be performed including as many as 200 separate vortex filaments or elemental surfaces for symmetric and 100 for unsymmetric aerodynamic loadings respectively. The extension of the incompressible solutions to compressible flows ( $0 < M < 1$ ) is accomplished via the Prandtl-Glauert transformation. Flight over a ground plane is calculated by the method of images as a special option of the program.

The output consists of data presented for ready engineering use such as pressure distributions, section coefficients, and spatially-integrated coefficients. Exact numerical solutions or arrays of solutions extrapolated using the lifting line theory from two or more exact vortex-lattice solutions may be output for multiple- and single-lifting-surfaces respectively. Other program features include: double precision matrix inversion, 4060-microfilm or Calcomp output, short or long print-format output, etc. An outline of the program analysis and execution options is presented in Pages 1-2 through 1-3.

## PROGRAM ABSTRACT (Contd.)

### ANALYTICAL MODEL FEATURES AND EXECUTION OPTIONS OUTLINE

#### ANALYSIS

- The aerodynamic airload distributions on single- or multiple-lifting surface configurations are calculated by an improved (TKW's) vortex-lattice method.
- The treatment of the control points is based on the exact geometry of the lifting surfaces, i.e., none of the usual linearization or other simplifying assumptions in the literature are incorporated in the analysis.
- The effect of leading-edge flow separation for theoretical-sharp leading edges (i.e., vortex-lift) is calculated by an approximate technique based on leading-edge suction analogy.
- Compressibility effects are accounted for via the Prandtl-Glauert transformation.
- Ground effects are calculated by the method of images that provides for exact analytical solutions for a flat ground plane of infinite extent, i.e., the boundary conditions of parallel flow at the ground plane are exactly satisfied.
- Arrays of solutions may be extrapolated from two exact vortex-lattice solutions by a method procedure based on the lifting-line theory.

#### VEHICLE CONFIGURATIONS

(See Table 1.01, Page 1-4)

- Single Surface: (XQT ISURF Option)  
A single surface of any configuration, shape, or form with or without severe surface discontinuities may be considered. This includes lifting surface configurations with flaps, ailerons, slots, with or without camber.
- Multiple Surfaces: (XQT NSURF Option)  
Up to five separate lifting surfaces of any configuration, shape, or form can be considered simultaneously. In each surface the effect of severe surface discontinuities can be considered in the same manner as outlined above for the single surface analysis. Multiple-lifting-surface configurations that may be analyzed include: wing-tail-fins, canard-wing-fins, thick-wing, lifting-body, and many other configurations. The complexity of the configurations that may be successfully analyzed depends on the maximum number of elemental panels or control points that can be considered simultaneously, i.e., 200 for symmetric and 100 for unsymmetric loadings respectively.

## PROGRAM ABSTRACT (Contd.)

### OUTPUT OPTIONS

- Printed Output
  - 1) Short-Print: the surface geometry, the airload force and pitching moment section coefficients, and all the force and moment spatially-integration airload coefficients are output for each of the lifting surfaces considered.
  - 2) Long-print: the short-print output, and the details of the lift (pressure coefficient) and vorticity distribution on each of the lifting surfaces considered are output.
  - 3) Debug-Print: the long-print output plus the details of the induced velocities and influence coefficients are output.
- Tape Output
  - 1) The lifting surface vortex-lattice geometry, section aerodynamic coefficients, etc. that are calculated in obtaining solutions are output on magnetic tape in the format required for executing the TRW plotting option, or
  - 2) By executing the plotting option (TRWPLT) included in the program, 4060-microfilm or Calcomp plots output of solutions (#1 above) can be obtained directly.

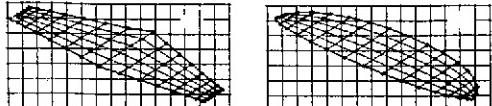
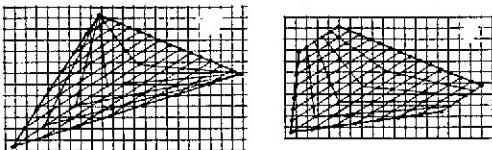
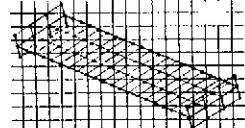
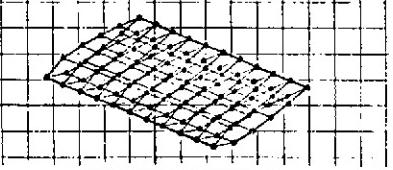
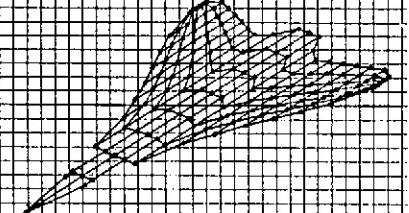
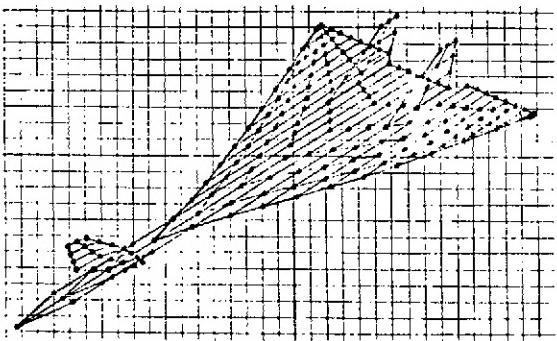
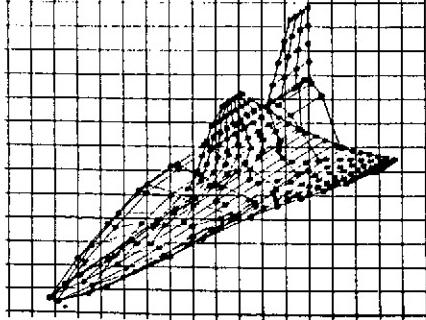
### SPECIAL OPTIONS

- Ground effects: flight in the presence of a very near ground plane may be calculated.
- Lifting-Line: arrays of solutions may be obtained by extrapolation from two exact vortex-lattice solutions using a method based on the lifting-line theory. This option at present (HA010B) is available only for single-lifting-surface configurations.

### EXECUTION TIME

- Symmetric loadings: about one minute per vortex-lattice solution for 100 elements.
- Unsymmetric loadings: about four minutes per vortex-lattice solution for 100 elements.
- With ground effects: about twice the time required for out-of-ground.
- Lifting-line arrays: about 1/2 minute extra running time.
- Maximum time: about four minutes and eight minutes per vortex-lattice solutions of out-of-ground and in-ground problems. The running times are based on 200 and 100 vortex-lattice elements for symmetric and unsymmetric loadings respectively.

TABLE 1.01 - REPRESENTATIVE LIFTING-SURFACE PROBLEMS OF VARIOUS CONFIGURATIONS THAT CAN BE SUCCESSFULLY SOLVED USING THE TRW VORTEX-LATTICE ANALYSIS PROGRAM NO. HA010B

VORTEX-LATTICE CONFIGURATION	NUMBER OF ELEMENTAL PANELS	EXECUTION TIME PER CASE	EVALUATION OF RESULTS
	80	34 sec	TYPE: THIN-SURFACE PROBLEM: WINGS OF AR = 6 RESULTS: VERY SUCCESSFUL DIFFICULTY: NONE
	70	30 sec	TYPE: THIN-SURFACE PROBLEM: WINGS OF LOW AR RESULTS: VERY SUCCESSFUL DIFFICULTY: NONE
	72	31 sec	TYPE: THIN-SURFACE PROBLEM: WING WITH END PLATES RESULTS: SATISFACTORY DIFFICULTY: SEVERE DISCONTINUITY
	100	42 sec	TYPE: THICK-SURFACE PROBLEM: WING THICKNESS RESULTS: VERY SUCCESSFUL DIFFICULTY: NONE
	112	63 sec	TYPE: THIN-SURFACE PROBLEM: DOUGLAS F5D-1 AIRPLANE RESULTS: VERY SUCCESSFUL DIFFICULTY: NONE
	162	98 sec	TYPE: THIN-SURFACE PROBLEM: NORTH AMERICAN XB-70 RESULTS: VERY SUCCESSFUL DIFFICULTY: NONE
	172	120 sec [vert. fin omitted]	TYPE: LIFTING-BODY PROBLEM: NASA-MSC #040A ORBITER RESULTS: NOT SUCCESSFUL DIFFICULTY: THE NUMBER OF ELEMENTAL PANELS THAT CAN BE CONSIDERED SIMULTANEOUSLY IS INSUFFICIENT TO PROVIDE VALID SOLUTIONS. BY NEGLECTING THE FUSELAGE THICKNESS THE THIN-SURFACE REPRESENTATION WAS APPLIED TO THIS PROBLEM VERY SUCCESSFULLY.

## 2.0 ANALYSIS

### 2.1 Analytical Procedures Review

It is a well known fact in aerodynamic theory that any surface, whether part of a body of finite thickness or merely an infinitesimally thin sheet, may be represented by a sheet of vorticity bound on the surface and a trailing vortex sheet shed behind the trailing edge. The velocity at any point in the flow field is the sum of the velocity vector induced by the vortex sheets and the free stream velocity vector. The strength of the vorticity representing the surface is determined by the requirement that the velocity vector computed as the sum of velocity induced by the vortex sheets and the free stream, be parallel to the surface. The strength of the trailing edge vortex sheet is determined from the surface bound vortex sheet strength using the conservation of vorticity laws for steady flow (i.e., Helmholtz vorticity laws) together with the requirement that there be no force exerted on the sheet, which means that the trailing edge vortex sheet must be everywhere parallel to the streamlines of the flow<sup>(1,2,3)†</sup>.

In the vortex lattice method, the influence of the surface is represented by a network of concentrated line vortices, distributed on the surface and behind the trailing edge<sup>(4,5)</sup>. The strength of these vortices is determined by the requirement that the flow be parallel to the surface at a number of boundary point or co-location points which are equal to the number of unknown vortex strengths. The location of the trailing vortices must be assumed, and thus may not happen to be exactly parallel to the streamlines. However, the path of the vortex sheet behind the wing may be guessed beforehand with fairly good accuracy, and since, in most instances, the results are not strongly influenced by the assumed path of the trailing vortices, excellent results of high accuracy are usually obtained<sup>(6)</sup>.

### 2.2 Vortex-Lattice Equations

The vortex lattice network arrangement used in the present analysis is illustrated in Figure 2.01<sup>‡</sup>. As shown in the figure, the wing surface is divided uniformly into a number of elemental panels of approximately equal size. The vorticity on the upper and lower surfaces of each panel is represented by a

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<sup>†</sup>Superscript in parenthesis denote references listed in Section 8.

<sup>‡</sup>Figures and Tables of this section are found at the end of the section.

single bound vortex line which is located in accordance with 2-D theory at the 1/4 chord of the panel<sup>(7)</sup>. The location of the control point or co-location point is arbitrary and is usually selected at the mid point between adjacent vortex lines which corresponds to the 3/4 chord of the panel. Since the vortex filaments cannot be discontinuous, the bound vortices for each panel are bent at both ends forming a pair of trailing vortices which must extend to infinity. In this manner these vortices represent the vorticity in the trailing edge vortex sheet. The bound vortex at the 1/4 chord of the panels and the pair of trailing vortex filaments define a generalized skew-shaped (oblique) horseshoe vortex filament of strength  $\Gamma$ . The number of horseshoe vortex filaments is equal to the number of panels or control points. The velocity at the control points is by definition parallel to the surface, and hence, the corresponding normal velocity components to the surface are exactly equal to zero. This boundary condition when applied to the jth panel is given by

$$\left( \vec{N}_j \right) \cdot \left( \frac{\vec{v}_\infty}{V_\infty} + \sum_{k=1}^K \frac{\Gamma_k / V_\infty}{4\pi} \vec{\psi}_{k(j)} \right) = 0 \quad (2.2.01)$$

where:

$\vec{N}_j$  = the unit vector normal to the surface at the jth control point,

$\vec{v}_\infty$  = the free stream velocity vector,

$V_\infty$  = the scalar magnitude of the free stream velocity vector,

$\Gamma_k$  = the strength of circulation of the kth panel horseshoe vortex filament,

$\vec{\psi}_{k(j)}$  = the induced velocity vector influence function of the kth panel horseshoe vortex evaluated at the jth control point,

K = the total number of panels for all the lifting surfaces considered.

The induced velocity vector and influence vector functions are calculated in accordance with the induced velocity law of Biot and Savart<sup>(2,3)</sup>. Using the geometry convention for a representative horseshoe vortex shown in Figure 2.02, it follows

$$\frac{\vec{v}_i(j)}{V_\infty} = \sum_{k=1}^K \frac{\Gamma_k / V_\infty}{4\pi} \vec{\psi}_{k(j)} \quad (2.2.02)$$

$$\vec{\psi}_{k(j)} = \oint \frac{d\vec{l} \times (\vec{r} - \vec{r}')}{|(\vec{r} - \vec{r}')|^3} \quad (2.2.03)$$

The calculation of the vector influence functions  $\vec{\psi}(j)$  are somewhat tedious but straightforward. In the present analysis the trailing vortices are assumed to be straight lines which extend to infinity and which are oriented at an angle  $\alpha/2$  in the manner shown in Figure 2.02. In this instance the bound vortex and trailing vortices for each panel form a generalized skew-shaped horseshoe vortex of the same configuration analysed in References 8 and 9. Analytical solutions for the vector influence functions are presented in Section 2.3. The number of unknown horseshoe filament circulation strengths  $\Gamma_k$  are equal to the number of boundary condition equations for the control points. Using matrix notation, these boundary conditions which were given in Equation 2.2.01, become

$$[A_j] + \left[ \frac{\Gamma_k}{V_\infty} \right] \times [B_{j,k}] = 0 \quad (2.2.04)$$

By inverting the matrix  $[B_{j,k}]$ , the unknown circulation strengths  $\Gamma_k$  are obtained

$$\left[ \frac{\Gamma_k}{V_\infty} \right] = - [A_j] \times \left\{ [B_{j,k}] \right\}^{-1} \quad (2.2.05)$$

In the presence of a ground plane, exact analytical solutions are obtainable by the method of images by assuming the ground plane to be perfectly flat and of infinite extent. Under these conditions, the boundary requirement for the flow at the ground plane is exactly satisfied by defining a mirror image of the vortex lattice directly below at a distance equal to twice the altitude from the ground plane. The calculation of the induced velocity (Equation 2.2.02) is modified to include the effect of the image vortex lattice influence coefficients as follows

$$\frac{\vec{v}_i(j)}{v_\infty} = \sum_{k=1}^K \frac{\Gamma_k/v_\infty}{4\pi} \left[ \vec{\psi}_{k(j)} - \vec{\psi}_{k(j)}^I \right] \quad (2.2.06)$$

$\vec{\psi}_{k(j)}^I$  = the influence function of the image vortex lattice.

Note that in the present formulation, none of the usual linearization or other simplifying assumptions were made on the boundary conditions at the control points (e.g., References 10 and 11). Therefore, severe variations in lifting surfaces planform such as twist, camber, dihedral, etc. are treated exactly and more accurate solutions may be obtained.

### 2.3 Influence Coefficients

Consider the straight vortex-filament element of length  $\Delta S$  that is illustrated in Figure 2.03. In computing the induced velocity vector for the vortex filament at a field point  $P(0,Y,Z)$ , the influence coefficient is obtained by integrating Equation 2.2.03 within the appropriate boundary conditions described in the figure. It follows

$$\vec{\Delta v} = \frac{\Gamma}{4\pi} \vec{\Delta \psi} \quad (\text{the induced velocity}) \quad (2.3.01)$$

$$\vec{\Delta \psi} = \vec{1V} \Delta \psi \quad (\text{the influence coefficient}) \quad (2.3.02)$$

where  $\vec{1V}$  and  $\Delta \psi$  are a unit vector and a scalar quantity, respectively. These are given by

$$\vec{1V} = - \vec{1AQ} \times \vec{1QP} = - \frac{Z}{R} \vec{1Y} + \frac{Y}{R} \vec{1Z} \quad (2.3.03)$$

$$\Delta \psi = \frac{1}{R} \left[ \frac{h + \Delta S}{\sqrt{(h + \Delta S)^2 + R^2}} - \frac{h}{\sqrt{h^2 + R^2}} \right] \quad (2.3.04)$$

$$R = \sqrt{Y^2 + Z^2} \quad (2.3.05)$$

The above equations can be used to determine the influence coefficient vector for any field point  $P(X,Y,Z)$  of any complex-shaped filament if it is assumed that it is composed of a discrete number of rectilinear increments  $\Delta L$  (illustrated in Figure 2.03) and by performing the appropriate coordinate transformations. For the generalized skew-shaped vortex filament in Figure 2.02,

the calculation of the influence coefficient vector for any flow field  $P(X,Y,Z)$  is performed in this manner. Making use of the localized coordinate system in Figure 2.04, the shape of the skew-shaped vortex filament is prescribed by the coordinates of points B-D given by

$$B = B(-c, -a, -d) \quad (2.3.06)$$

$$D = D(c, a, d) \quad (2.3.07)$$

$$c = a \tan(\Lambda) \quad (2.3.08)$$

$$d = a \tan(\phi) \quad (2.3.09)$$

If the vortex filament is broken into three elements, i.e.,  $\infty-A-B$ ,  $D-E-\infty$ , and  $B-C-D$ , the influence coefficient vector for the filament is equal to the sum

$$\vec{\psi} = \sum_{i=1}^3 \vec{IV}_i \Delta \psi_i \quad (2.3.10)$$

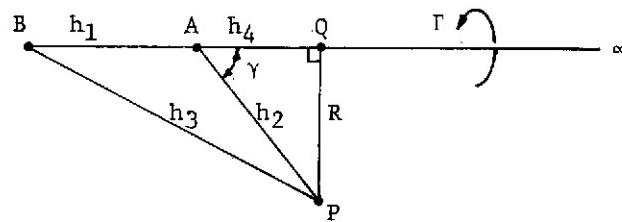
#### Segment #1 ( $\infty-A-B$ )

The contribution of segment #1 for an arbitrary field point  $P(X,Y,Z)$  is calculated as follows. The coordinates of point A are given by

$$A = A(X, -a, -d') \quad (2.3.11)$$

$$d' = d + (X + c) \tan(a/2) \quad (2.3.12)$$

and making use of the geometry according to the sketch below,



$$h_1 = \sqrt{(X + c)^2 + (d' - d)^2} \quad (2.3.13a)$$

$$h_2 = \sqrt{(Y + a)^2 + (Z + d)^2} \quad (2.3.13b)$$

$$h_3 = \sqrt{(X + c)^2 + (Y + a)^2 + (Z + d)^2} \quad (2.3.13c)$$

$$\cos(\gamma) = -\frac{h_1^2 + h_2^2 - h_3^2}{2h_1 h_2} \quad (2.3.13d)$$

$$R = h_2 \sqrt{1 - (\cos \gamma)^2} \quad (2.3.13e)$$

$$h_4 = h_2 \cos(\gamma) \quad (2.3.13f)$$

Using Equation 2.3.04, the scalar part of the influence coefficient can now be computed

$$\Delta \psi_1 = \frac{1}{R} \left[ 1 + \frac{h_1 + h_4}{\sqrt{(h_1 + h_4)^2 + R^2}} \right] \quad (2.3.14)$$

The calculation of the vector part of the influence coefficient will be considered next. The coordinates of point Q shown on the sketch are

$$Q = Q(X_q, Y_q, Z_q) \quad (2.3.15a)$$

$$X_q = -c + (h_1 + h_4) \cos(\alpha/2) \quad (2.3.15b)$$

$$Y_q = -a \quad (2.3.15c)$$

$$Z_q = -d - (h_1 + h_4) \sin(\alpha/2) \quad (2.3.15d)$$

and the unit vectors for the line segments B-Q and Q-P can now be calculated

$$\vec{IBQ} = \vec{IX} \cos(\alpha/2) - \vec{IZ} \sin(\alpha/2) \quad (2.3.16)$$

$$\vec{IQP} = \vec{IX} \left( \frac{X - X_q}{R} \right) + \vec{IY} \left( \frac{Y - Y_q}{R} \right) + \vec{IZ} \left( \frac{Z - Z_q}{R} \right) \quad (2.3.17)$$

then, the vector part of the influence coefficient, i.e., a unit vector, is given by the vector cross-product

$$\overrightarrow{1V_1} = \overrightarrow{1BQ} \times \overrightarrow{1QP} \quad (2.3.18)$$

### Segment #2 (D-E-∞)

The contribution of segment #2 for the same arbitrary field point P(X,Y,Z) is calculated in the same manner as outlined for segment #1; specifically, Equations 2.3.19 through 2.3.23 are used in place of 2.3.11, 2.3.12, 2.3.13, and 2.3.15 respectively, where

$$E = E(X, a, +d') \quad (2.3.19)$$

$$d' = d - (X - c) \tan(\alpha/2) \quad (2.3.20)$$

$$h_1 = \sqrt{(X - c)^2 + (d - d')^2} \quad (2.3.21a)$$

$$h_2 = \sqrt{(Y - a)^2 + (Z - d)^2} \quad (2.3.21b)$$

$$h_3 = \sqrt{(X - c)^2 + (Y - a)^2 + (Z - d)^2} \quad (2.3.21c)$$

$$X_q = c + (h_1 + h_4) \cos(\alpha/2) \quad (2.3.22a)$$

$$Y_q = a \quad (2.3.22b)$$

$$Z_q = d - (h_1 + h_4) \sin(\alpha/2) \quad (2.3.22c)$$

$$\overrightarrow{1V_2} = -\overrightarrow{1DQ} \times \overrightarrow{1QP} \quad (2.3.23a)$$

$$\overrightarrow{1DQ} = \overrightarrow{1BQ} \quad (2.3.23b)$$

Segment #3 (B-C-D)

The contribution of segment #3 for the same arbitrary field point P(X,Y,Z) considered for segments #1 and #2 is calculated in a like manner as outlined in detail for segment #1. For segment #3, the coordinates of points B(-c,-a,-d) and D(c,a,d) are used to determine the solutions for

$$h_1 = \sqrt{c^2 + a^2 + d^2} \quad (2.3.24a)$$

$$h_2 = \sqrt{(X - c)^2 + (Y - a)^2 + (Z - d)^2} \quad (2.3.24b)$$

$$h_3 = \sqrt{(X + c)^2 + (Y + a)^2 + (Z + d)^2} \quad (2.3.24c)$$

$$\cos(\gamma) = -\frac{h_1^2 + h_2^2 - h_3^2}{2h_1 h_2} \quad (2.3.24d)$$

$$h_4 = h_2 \cos(\gamma) \quad (2.3.24e)$$

$$R = h_2 \sqrt{1 - (\cos \gamma)^2} \quad (2.3.24f)$$

and using Equation 2.3.04, the scalar part of the influence coefficient for segment #3 (B-D) can now be computed

$$\Delta\psi_3 = \frac{1}{R} \left[ \frac{h_1 + h_4}{\sqrt{(h_1 + h_4)^2 + R^2}} - \frac{h_4}{\sqrt{h_4^2 + R^2}} \right] \quad (2.3.25)$$

Next, to calculate the vector part of the influence coefficient the coordinates of point Q(X<sub>q</sub>, Y<sub>q</sub>, Z<sub>q</sub>) must be calculated first. Accordingly

$$X_q = c + h_4 (2c/h_1) \quad (2.3.26a)$$

$$Y_q = a + h_4 (2a/h_1) \quad (2.3.26b)$$

$$z_q = d + h_4 \left(2d/h_1\right) \quad (2.3.26c)$$

The unit vectors  $\vec{IBQ}$  and  $\vec{IQP}$  are given by

$$\vec{IBQ} = \vec{IX} \left(\frac{2c}{h_1}\right) + \vec{IY} \left(\frac{2a}{h_1}\right) + \vec{IZ} \left(\frac{2d}{h_1}\right) \quad (2.3.27)$$

$$\vec{IQP} = \vec{IX} \left(\frac{x - x_q}{R}\right) + \vec{IY} \left(\frac{y - y_q}{R}\right) + \vec{IZ} \left(\frac{z - z_q}{R}\right) \quad (2.3.28)$$

from which the vector part of the influence coefficient, i.e., the unit vector  $\vec{IV}_3$ , can be calculated by simply taking the vector cross-product

$$\vec{IV}_3 = - \vec{IBQ} \times \vec{IQP} \quad (2.3.29)$$

#### 2.4 Exact-Theory Aerodynamic Forces and Moments

The net aerodynamic force vector exerted on the jth panel (i.e., jth elemental surface) is calculated using

$$\frac{\vec{F}_j}{\rho_\infty V_\infty^2} = \frac{\left(\frac{\vec{V}_j}{V_\infty} \times \vec{\Delta L}_j\right) \frac{\Gamma_j}{V_\infty}}{\beta} \quad (2.4.01)$$

$$\frac{\vec{V}_j}{V_\infty} = \frac{\vec{V}_\infty}{V_\infty} + \sum_{k=1}^K \frac{\Gamma_k / V_\infty}{4\pi} \vec{\psi}_{k(j)} \quad (2.4.02)$$

where

$\vec{\Delta L}_j$  = the length vector of the bound vortex filament of the panel,

$\vec{V}_j$  = the velocity vector computed as the sum of free stream and induced velocity vectors evaluated at the midpoint of the bound vortex of the jth panel,

$\beta$  = the Prandtl-Glauert compressibility factor, =  $\sqrt{1 - M_\infty^2}$

$\vec{\psi}_k(j)$  = the vector influence function of the  $k$ th panel evaluated at midpoint of the  $j$ th bound vortex.

The force vector  $\vec{F}_j$  is assumed to act at the midpoint of the bound vortex filament of the  $k$ th panel. The corresponding section aerodynamic load coefficients and integrated wing force and moment coefficients are obtained by the appropriate summation of the forces  $\vec{F}_j$  acting on each panel. In determining these quantities the following relations derived from the exact analysis are used

#### Force Coefficients for $j$ th Panel

$$c_{F_{X,j}} = 2 \left( \frac{\vec{F}_j / (\rho_\infty v_\infty^2)}{\Delta S_j} \right) \cdot (\vec{1X}) \quad (2.4.03)$$

$$c_{F_{Y,j}} = 2 \left( \frac{\vec{F}_j / (\rho_\infty v_\infty^2)}{\Delta S_j} \right) \cdot (\vec{1Y}) \quad (2.4.04)$$

$$c_{F_{Z,j}} = 2 \left( \frac{\vec{F}_j / (\rho_\infty v_\infty^2)}{\Delta S_j} \right) \cdot (\vec{1Z}) \quad (2.4.05)$$

#### Differential Pressure Coefficients

$$(c_{P_L} - c_{P_U})_j = 2 \left| \left( \frac{\vec{F}_j / (\rho_\infty v_\infty^2)}{\Delta S_j} \right) \right| \quad (2.4.06)$$

#### Lifting Surface Section Airload Coefficients

For each lifting surface, by summing up the appropriate force contributions,

$$c_n(Y) = - \frac{1}{C} \sum c_{F_{Z,j}} \left. \frac{\Delta S_j}{\Delta Y_j} \right|_Y \quad (2.4.07)$$

$$c_t(Y) = - \frac{1}{C} \sum c_{F_{X,j}} \left. \frac{\Delta S_j}{\Delta Y_j} \right|_Y \quad , \quad (2.4.08)$$

$$c_m(Y) = \frac{1}{C^2} \sum \left[ c_{F_{Z,j}} \left. \frac{\Delta S_j}{\Delta Y_j} \right| (x_j - x_{(C/4)}) + c_{F_{X,j}} \left. \frac{\Delta S_j}{\Delta Y_j} \right| (z_j - z_{(C/4)}) \right]_Y \quad (2.4.09)$$

$$c_{L(Y)} = c_{n(Y)} \cos(\alpha) + c_{t(Y)} \sin(\alpha) \quad (2.4.10)$$

$$c_{d_i(Y)} = -c_{t(Y)} \cos(\alpha) + c_{n(Y)} \sin(\alpha) \quad (2.4.11)$$

Lifting Surface Spatially-Integrated Airload Coefficients

$$C_N = -\frac{1}{S} \sum_j c_{F_{Z,j}} \Delta S_j \quad (2.4.12)$$

$$C_T = -\frac{1}{S} \sum_j c_{F_{X,j}} \Delta S_j \quad (2.4.13)$$

$$C_{M_P(\bar{C}/4)} = \frac{1}{S \bar{C}} \sum_j \Delta S_j \left( c_{F_{Z,j}} x_{a_j} - c_{F_{X,j}} z_{a_j} \right) \quad (2.4.14)$$

$$C_{M_R(\bar{C}/4)} = \frac{1}{S \bar{C}} \sum_j \Delta S_j \left( c_{F_{Y,j}} z_{a_j} - c_{F_{Z,j}} y_{a_j} \right) \quad (2.4.15)$$

$$C_{M_Y(\bar{C}/4)} = \frac{1}{S \bar{C}} \sum_j \Delta S_j \left( c_{F_{Y,j}} x_{a_j} - c_{F_{X,j}} y_{a_j} \right) \quad (2.4.16)$$

$$C_L = C_N \cos(\alpha) + C_T \sin(\alpha) \quad (2.4.17)$$

$$C_{D_i} = -C_T \cos(\alpha) + C_N \sin(\alpha) \quad (2.4.18)$$

$$x_{a_j} = x_j - x_{(\bar{C}/4)} \quad (2.4.19)$$

$$y_{a_j} = y_j \quad (2.4.20)$$

$$z_{a_j} = z_j - z_{(\bar{C}/4)} \quad (2.4.21)$$

In equations 2.4.07 through 2.4.16 the summations are performed over the vortex-lattice elemental surfaces that correspond to each lifting surface. To obtain the total force for the sum of N lifting surfaces, the summation is carried out over all the panels ( $j=1,J$ ) and the reference dimensions for the first lifting surface ( $n=1$ ) are used.

## 2.5 Approximate-Theory Aerodynamic Forces and Moments

In the preceding sections the procedure for obtaining exact solutions for the aerodynamic forces and moments by the vortex lattice method were developed. To generate an array of such solutions (for instance by varying the wing angle of attack) would be considered unwise because of the excessive computing time expenditure required. Instead, an array of approximate solutions of sufficient engineering accuracy may be obtained by extrapolation from two exact vortex lattice solutions by using the lifting line theory. Accordingly, for a single lifting surface, given two exact solutions obtained at two different angles of attack  $\alpha_1$ , and  $\alpha_2$ , the extrapolated solutions for any other angle of attack  $\alpha$  may be obtained in the following manner.

### Wing Lift Coefficient

$$\bar{m} = \frac{c_{L1} - c_{L2}}{\alpha_1 - \alpha_2} \quad (2.5.01)$$

$$\alpha R_o = \alpha_1 - \frac{c_{L1}}{\bar{m}} \quad (2.5.02)$$

$$c_L = \bar{m} (\alpha - \alpha R_o) \quad (2.5.03)$$

### Wing Moment Coefficients (Pitching, Rolling, and Yawing) about $\bar{C}/4$

$$c'_M = \frac{c'_{M1} - c'_{M2}}{c_{L1} - c_{L2}} \quad (2.5.04)$$

$$c_{Mo} = c_{M1} - c'_M c_{L1} \quad (2.5.05)$$

$$c_M = c_{Mo} + c'_M c_L \quad (2.5.06)$$

### Wing Section Lift Coefficients

$$c_{\ell a_1}(Y) = \frac{c_{\ell 1}(Y) - c_{\ell 2}(Y)}{C_L 1 - C_L 2} \quad (2.5.07)$$

$$c_{\ell b}(Y) = c_{\ell 1}(Y) - c_{\ell a_1}(Y) C_L 1 \quad (2.5.08)$$

$$c_{\ell}(Y) = c_{\ell a_1}(Y) C_L + c_{\ell b}(Y) \quad (2.5.09)$$

### Wing Section Induced Drag Coefficients

$$c_{d_i}'(Y) = \left( \frac{c_{d_i 1} - c_{d_i 2}}{c_{\ell 1}^2 - c_{\ell 2}^2} \right) (Y) \quad (2.5.10)$$

$$c_{d_i o}(Y) = c_{d_i 1}(Y) - c_{d_i}'(Y) c_{\ell 1}(Y)^2 \quad (2.5.11)$$

$$c_{d_i}(Y) = c_{d_i o} + c_{d_i}'(Y) c_{\ell}(Y)^2 \quad (2.5.12)$$

or using the lifting line theory exact results,

$$c_{d_i}(Y) = \left[ \frac{1}{m c_{\ell a_1}(Y)} - \frac{1}{2\pi} \right] c_{\ell}(Y)^2 \quad (2.5.13)$$

Equation 2.5.13 is recommended in the analysis of wing planforms of moderate aspect ratio and negligible sweep and dihedral angles.

### Wing Induced Drag Coefficient

$$C_{D_i} = \frac{1}{S} \int_{-b/2}^{+b/2} c_{d_i}(Y) C(Y) dY \quad (2.5.14)$$

which when expressed as a function of  $C_L$  becomes

$$C_{D_i} = C_{D_i o} + C_{D_i 1} C_L + C_{D_i 2} C_L^2 \quad (2.5.15)$$

The coefficients  $C_{D_{i_0}}$ ,  $C_{D_{i_1}}$  and  $C_{D_{i_2}}$  are constants which may be evaluated from three separate approximate solutions.

#### Drag Due to Skin Friction

$$cd_f = 2 CF \quad (\text{CONSTANT}) \quad (2.5.16)$$

$$C_{D_f} = cd_f \quad (2.5.17)$$

where CF is the aerodynamic cleanliness factor which is defined as

$$CF = \frac{\text{EQUIVALENT FLAT PLATE AREA}}{\text{WETTED AREA}} = \frac{C_D \pi S_\pi}{2S} \quad (2.5.18)$$

The total drag coefficients are obtained as the sum of induced drag and skin friction drag for the wing section coefficients and the integrated wing coefficients respectively.

#### 2.6 Vortex Lift

Experimental studies of sharp leading edge delta wings have shown that at even relatively low angles of attack the flow separates from the leading edge and rolls up into two vortex sheets or cone shaped cores of rotating fluid particles with the axes of rotation located approximately parallel to the leading edges<sup>(12,13)</sup>. In general, this vortex flow results in an increase in lift that is called vortex lift or non-linear lift, and an increase in drag resulting from the loss of leading edge suction. Although it is desirable to avoid the formation of the separated flow vortex sheets because of the high drag, it is a phenomenon which is always encountered by low aspect ratio highly swept wings operating near the stalling attitude. Furthermore, the separated vortex flow phenomenon is not restricted to this type of wing planform but is a general characteristic of all sharp leading-edge wings regardless of their leading-edge sweep angle.

The attached flow and separated vortex flow over blunt and sharp leading edge wings respectively are schematically illustrated in Figure 2.05. For the attached flow (blunt leading edges) there exists a net thrust force which is called the leading edge suction. This force may be interpreted to be

exerted by the bound vortex filaments at the leading edge. For sharp leading edges, attached flow cannot exist because of the infinitely large velocity and low pressure required, and therefore, the flow separates locally displacing the leading edge bound vortex filaments into the cavity formed by the separated flow. The vortex filaments in the cavity are not free vortices and therefore they will exert a net force in the normal direction to the wing surface because of the reorientation of the velocity vector.

Exact analytical solutions for sharp leading edge wings with leading edge separated flow are available in the published literature for a very restrictive range of wing geometries<sup>(14,15,16)</sup>. Usually these solutions are based on the assumption of conical flow, and as a consequence, only perfect delta wing planforms which feature no twist, no camber, and straight trailing edges can be considered. Therefore, in the prediction of the vortex lift for arbitrary sharp leading edge wing planforms, only empirical methods or approximate theory is available. The most successful analytical techniques are based on the vortex-lift leading-edge suction analogy. The method is based on the assumption that the vortex lift vector can be estimated from the leading edge thrust or suction force associated with the flow over the wing planform without separated flow at the leading edge. It follows (see Figure 2.05)

$$\Delta c_{n_v} = \frac{c_t}{\cos(\Delta_{LE})} \left( \frac{\alpha}{|\alpha|} \right) \quad (2.6.01)$$

$$\Delta c_{t_v} = -c_t \quad (2.6.02)$$

$$\Delta c_{m_v(c/4)} = -\Delta c_{n_v} \left( \frac{x_{LE} - x_{(C/4)}}{C} \right) \quad (2.6.03)$$

$$\Delta c_{l_v} = \Delta c_{n_v} \cos(\alpha) + \Delta c_{t_v} \sin(\alpha) \quad (2.6.04)$$

$$\Delta c_{d_v} = -\Delta c_{t_v} \cos(\alpha) + \Delta c_{n_v} \sin(\alpha) \quad (2.6.05)$$

These increments represent the force and moment coefficients due to the vortex lift which must be added to each lifting surface section coefficients in order to

obtain the net forces on the wing corresponding to the case of no leading edge suction. In the derivation of these relations, the vortex lift distribution has been assumed to act at the leading edge and normal to the wing chord plane.

Because of the approximate manner in which the leading edge suction thrust coefficient is calculated the evaluation for the vortex lift effects are only applicable to lifting surface planforms having a flat chord plane. Note that the thrust coefficient is calculated by integration of the forces in chordwise strips acting in all the bound vortices of the vortex-lattice matrix. Such an integration will provide accurate evaluations of the leading edge thrust if the chord plane is flat or if a very large number of chordwise rows are considered. If an infinite number of chordwise rows are considered, the vortex-lattice method will provide solutions equivalent to the potential flow solutions and an exact evaluation of the leading edge suction force will result. In the latter case, the leading edge suction thrust coefficient could be evaluated from the force exerted by a few of the leading edge bound vortices.

The spatially integrated wing coefficient increments due to the leading edge vortex lift are calculated from the wing section coefficient span distributions given in Equations 2.6.01 through 2.6.05, as follows

$$\Delta C_{L_v} = \frac{1}{S} \int_{-b/2}^{+b/2} \Delta c l_v C dY \quad (2.6.06)$$

$$\Delta C_{D_v} = \frac{1}{S} \int_{-b/2}^{+b/2} \Delta c d_v C dY \quad (2.6.07)$$

$$\begin{aligned} \Delta C_{M_p,v(\bar{C}/4)} &= \frac{1}{S C} \int_{-b/2}^{+b/2} \left[ -\Delta c_{n_v} (x_{LE} - x_{(\bar{C}/4)}) \right. \\ &\quad \left. + \Delta c_{t_v} (z_{LE} - z_{(\bar{C}/4)}) \right] C dY \end{aligned} \quad (2.6.08)$$

For obtaining approximate solutions of the vortex lift at selected wing angles of attack from two or more exact vortex lattice solutions, the following assumption is made which yields accurate results

$$\Delta c_{n_v}(Y, \alpha) = C_1(Y) + C_2(Y) - \frac{\alpha^3}{|\alpha|} \quad (2.6.09)$$

$$\Delta c_{t_v}(Y, \alpha) = C_3(Y) + C_4(Y) - \frac{\alpha^2}{|\alpha|} \quad (2.6.10)$$

The quantities  $C_1$ ,  $C_2$ ,  $C_3$ , and  $C_4$  are constants which are evaluated from the two vortex lattice solutions obtained at different angles of attack  $\alpha_1$  and  $\alpha_2$  in the manner described in Section 2.5.

## 2.7 Surface Discontinuities

Surface discontinuities occurring in the wing surface such as those encountered at the aileron-flap juncture cannot be treated exactly by the vortex lattice solution technique. Although by increasing the number of elements or control points the accuracy of the solutions should in principle be improved, sharp discontinuities in the surface may cause local oscillations on the solutions that become more severe as the number of elements are increased. To circumvent this problem, a cosine smoothing option whose effect is illustrated in Figure 2.06 has been adopted. The affected span length  $\delta$  is prescribed by the program user as an execution input. A value of 1/5 of the semispan is recommended. In addition, various other options for spacing the elements in the spanwise and chordwise directions have been made available. These include constant spacing, cosine spacing, and spacing prescribed as an execution input. For deflected control surfaces, a minimum of four elements of approximate equal size per chordwise row is recommended, the last element corresponding to the deflected surface.

The airload section coefficients for the flapped surfaces are calculated in a similar manner to the wing section coefficients (Section 2.4). By considering only the forces on the bound vortices on the flapped surfaces  $(x_j - x_{h,j})$  it follows

$$c_{n_f}(Y) = -\frac{1}{c_f} \sum c_{F_z,j} \left| \frac{\Delta S_j}{\Delta Y_j} \right|_{Y, (x_j - x_{h,j})} \quad (2.7.01)$$

$$c_{t_f}(Y) = -\frac{1}{c_f} \sum c_{F_x,j} \left| \frac{\Delta S_j}{\Delta Y_j} \right|_{Y, (x_j - x_{h,j})} \quad (2.7.02)$$

$$c_{h_f}(Y) = \frac{1}{c_f^2} \sum \left[ c_{F_{Z,j}} \frac{\Delta S_j}{\Delta Y_j} (x_j - x_{h,j}) + c_{F_{Z,j}} \frac{\Delta S_j}{\Delta Y_j} (z_j - z_{h,j}) \right]_{Y, (x_j - x_{h,j})} \quad (2.7.03)$$

$$c_{l_f}(Y) = c_{n_f}(Y) \cos(\alpha) + c_{t_f}(Y) \sin(\alpha) \quad (2.7.04)$$

$$c_{d_{1,f}}(Y) = -c_{t_f}(Y) \cos(\alpha) + c_{n_f}(Y) \sin(\alpha) \quad (2.7.05)$$

For obtaining approximate solutions (see Section 2.5) the following assumptions are made

$$c_{l_f}(Y, \alpha) = F_1(Y) + F_2(Y) \alpha \quad (2.7.06)$$

$$c_{d_{1,f}}(Y, \alpha) = F_3(Y) + F_4(Y) (c_{l_f}(Y, \alpha))^2 \quad (2.7.07)$$

$$c_{h_f}(Y, \alpha) = F_5(Y) + F_6(Y) \alpha^2 \quad (2.7.08)$$

The quantities  $F_1, F_2, \dots F_6$  are constants which are evaluated from two exact vortex lattice solutions obtained at different angles of attack  $\alpha_1$  and  $\alpha_2$ .

## 2.8 Lift in the Presence of a Fuselage

Two options for calculating the lift in the presence of a generalized cylindrical-shaped fuselage are possible:

### 1) Analytical Method - Circular Shaped Fuselage

In this method the effect of a circular shaped fuselage of radius  $R$  and of infinite length is analyzed by the method of images. According to the hydrodynamic theory, the boundary conditions of zero normal flow to the fuselage surface due to wing trailing vortices are satisfied by defining a pair of vortex filament images inside the fuselage. Since the free stream velocity vector is neglected in satisfying the boundary conditions on the fuselage, only approximate solutions which are valid at small angles of attack are obtainable (i.e., the fuselage attitude is oriented parallel to the wing trailing vortices). Using cylindrical coordinates with the axis of symmetry located at the center of the fuselage, the location of the pair of images

for a wing trailing vortex filament is determined from

Image # 1

$$x_I = x$$

$$\vec{r}_I = \vec{r} \left( \frac{R}{|\vec{r}|} \right)^2$$

$$\Gamma_I = -\Gamma$$

Image # 2 <sup>†</sup>

$$x_I = x$$

$$\vec{r}_I = 0$$

$$\Gamma_I = \Gamma$$

(63)

(64)

(65)

where

$x$   
 $\vec{r}$   
 $\Gamma$

} the coordinates and circulation strength at a point in a wing trailing vortex filament.

The calculation of the induced velocity of the pair of images is performed by integration in the manner outlined in Section 2.3 from which the calculation of the induced velocity vector influence functions follows.

The effect of the presence of a circular shaped fuselage on the wing bound vortices cannot be determined by exact analysis except under very restrictive assumptions for the wing geometry. Therefore, a relatively simple and approximate approach has to be adopted. The effect of the presence of the fuselage on the velocity induced by the bound vortices is assumed to be the same as its effect on a two-dimensional uniform rectilinear flow. Thus, the velocity component induced by the bound vortices at some point P in the flow field is increased by a factor

$$\left[ 1 + \left( \frac{R}{|\vec{r}_{(P)}|} \right)^2 \right] \quad (2.8.04)$$

which is an exact correction for a straight and infinite bound vortex line intersecting the cylinder axis of symmetry at 90°. The approximation will be valid for wings having small sweepback angles and slender fuselages centered at the wing axis of symmetry.

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<sup>†</sup>The sum of the contribution of images #2 will be zero for symmetric wing loadings.

## 2) Vortex-Lattice Method - Arbitrary Shaped Fuselage

The effect of the presence of an arbitrary shaped fuselage on the wing lift can be calculated using the vortex lattice method.<sup>†</sup> The accuracy of the solutions that are obtained depends on the selection of the number of control points and their location on the fuselage surface. For accurate calculation of the fuselage it would probably require an equal or larger number of control points on the fuselage surface than the number used for the wing. The main advantages of using the vortex-lattice method in preference to other analytical methods (e.g., the method of images) are: (1) non-planar wings of arbitrary planform may be analyzed, (2) no restriction is placed on the cross section, length or shape of the fuselage, and (3) the accuracy desired for obtaining solutions can be obtained by increasing the number of panels or by varying the location of the control points at the surface of the fuselage. In the present vortex-lattice program (HA010B), the treatment of exact fuselage-wing vehicle configurations is severely limited by the total number of elemental vortex-filament surfaces (about 100) that can be considered simultaneously. At present, only by an approximate representation of the fuselage (e.g., by defining an equivalent flat surface) can the fuselage-wing configurations be analyzed by the program.

## 2.9 Program Qualification Tests

The vortex lattice method is suitable for determining accurate solutions for the aerodynamic loads on lifting surfaces of arbitrary planforms. Nevertheless, for conventional wing planforms featuring negligible dihedral and small camber, generally more exact analytical solution methods based on the integral lifting surface<sup>(7)</sup> and lifting line theories<sup>(16)</sup> are available. These solutions and equivalent experimental test results have been used to demonstrate the accuracy of the present vortex-lattice analytical method.<sup>(8)</sup> For wing planforms with severe surface discontinuities, only comparisons

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<sup>†</sup>It is a well known fact in hydrodynamic theory that the presence of arbitrary bodies immersed in a steady subsonic or supersonic flow field can be represented by distributions of sources and sinks inside the volume occupied by the bodies. Mathematically, the distributions of sources and sinks may be replaced by distributions of doublets or vortex filaments located on the surface of the bodies. If the vortex filament representation is adopted (i.e., the vortex lattice method), a rectangular vortex ring for each panel in the surface of the bodies is defined with the corresponding control points located at the center of each panel.

against available experimental test results can be performed. In general it should be noted that: (1) the vortex lattice solutions are affected by the number of surface elements, the location of the control points, and the geometric arrangement of the vortex lattice network which are input quantities prescribed by the program users, (2) for conventional wing planforms with moderate aspect ratio and moderate dihedral and sweepback angles, the lifting line methods will provide more accurate solutions, and (3) when the wing surface is placed very near a ground plane, large differences in the span and chord lift distributions in comparison with out-of-ground conditions occur; therefore, ground effects can only be properly analyzed by the integral lifting surface or the vortex lattice method. In the lifting line method the local section aerodynamic characteristics are assumed to depend only on the airfoil section properties for two dimensional flow (i.e., infinite aspect ratio) which are generally determined from wind tunnel tests.<sup>(17, 18)</sup> In the presence of a very near ground plane this assumption is not valid.

#### 2.9.1 Vortex-Lattice Geometry and Control Point Locations

The effect of varying the vortex lattice geometric arrangement for a fixed wing planform on the solution of the spatially integrated wing airload coefficients is demonstrated in Table 2.01. Predictions are presented for a delta wing planform of aspect ratio of two. Both constant spacing and cosine spacing of the elements in the spanwise and chordwise directions are considered. Nevertheless, the differences between solutions on the integrated wing coefficients is found to be negligible, i.e., within one percent. On the other hand, the variation of the vortex lattice arrangement due to constant and variable (cosine) spacing of the elements shows a significant effect on the predictions for the spanwise section lift distribution in the region near the wing tip (see Figure 2.07). Based on the results presented, it is concluded that constant span spacing of the elements provides more reasonable solutions than variable spacing for wings of low aspect ratio ( $\sim 2$ ). For moderate to high aspect ratio wings, the opposite is found to be true. As a general rule, accurate solutions are obtained by selecting not less than ten spanwise elements and not less than four chordwise elements. The spacing of the elements should be such that adjacent elements have approximately equal size and equal configuration. Furthermore, the accuracy of the predicted spatially integrated wing coefficients depends primarily on the total number

of elements considered, i.e., errors in the calculated local airload coefficients will cancel out in the integration process.

The effect of varying the control point locations on the wing integrated airload coefficients for a delta wing of aspect ratio of two is presented in Table 2.02. As shown in the table, by moving the control points aft of the 3/4 chord of the panels, an increase in the wing airloads and a forward shift of the center of pressure results. Similar conclusions are drawn for wings of moderate aspect ratio and negligible sweepback angles (see Table 2.03). Although for the low aspect ratio delta wing planforms better agreement between analytical and experimental solutions are obtained with the control point locations aft of the 3/4 chord of the panels, the best control point location which provides accurate results for any wing planform is considered to be at the 77 percent of the elemental chords. (7, 19)

#### 2.9.2 Wings of Moderate Aspect Ratio and Negligible Sweepback

Three different basic wing planforms of aspect ratio of six having no twist and zero sweepback at the 1/4 chord are considered. Solutions for the integrated wing airload coefficients using the present vortex lattice program and the lifting line theory<sup>(18)</sup> are compared in Table 2.03. The lattice network arrangements and corresponding section lift distributions for the vortex lattice solutions are shown in Figure 2.08. The comparison of the calculated span loadings for the rectangular and the straight tapered wings against lifting line semi-empirical predictions<sup>(20, 21)</sup> is presented in Figure 2.09. A qualitative evaluation of results shows that the program predictions are in good agreement with the lifting line exact theory and the lifting line semi-empirical predictions.

#### 2.9.3 Wings of Low Aspect Ratio and Large Sweepback

Wing planforms of low aspect ratio having no twist and large leading edge sweepback angles for which comprehensive wind tunnel test data are available are considered.<sup>(23, 24)</sup> The range of wing planforms includes delta, clipped delta, and straight tapered configurations of aspect ratios ranging from two to four and leading edge sweepback angles as large as 60° (see Table 2.04). The airfoil sections are relatively thin (~ 3 percent) with sharp or rounded nose sections. Under these conditions locally separated flow at the wing leading edge with the accompanying vortex lift and loss of leading edge suction force occurs. Analytical solutions for the wing plan-

forms were generated by the program assuming no separated flow and fully separated flow at the leading edges. Analytical predictions for the integrated airload coefficients are compared with the experimental test results in Table 2.04. Comparisons for a range in angle of attack from  $0^\circ$  to  $25^\circ$  are shown for four representative wing planforms in Figures 2.10 through 2.12. Comparisons of the lift distribution on the lifting surface for a delta wing planform are presented in Figure 2.13. The analytical solutions in the table and the figures were calculated assuming a control point location of 77 percent of chord for the elemental panels. An evaluation of the overall results leads to the following conclusions.

- 1) The analytical solutions for the integrated wing lift coefficients are found in excellent agreement with the wind tunnel test results (Figure 2.10). In general, the analytical solutions with and without leading edge suction bound the experimental results.
- 2) Analytical solutions for the wing drag coefficients when compared with the experimental results, although in less agreement, showed the same trends as for the lift (Figure 2.11).
- 3) The analytical solutions for the integrated wing pitching moment coefficients about the  $1/4$  of the mean geometric chord are not found to be in good agreement with the wind tunnel test results (Figure 2.12). Differences of the order of 25 percent are encountered for the delta wing planform of aspect ratio of two and somewhat smaller for the other wings. The reasons for the discrepancies encountered for the pitching moment probably arise from two sources. First, the test data for the wings were deduced from tests conducted for wings with a slender fuselage. To obtain the characteristics of wing alone, data for the fuselage alone was subtracted from the wing-fuselage data and, as a result, the wing-fuselage interference effect was neglected. Second, for the delta wing configurations the calculated lift in the tip regions is extremely large while in the real test environment stalling in these regions would surely occur. This would result in a redistribution of the vorticity on the wing upper and lower surfaces which cannot be represented accurately by the vortex lattice theory (see Figure 2.13). In addition, it should be noted that the pitching moment error for the  $\bar{C}/4$  location is somewhat

misleading in assessing the accuracy of the vortex lattice method since at this location the magnitude of the pitching moment is of zero order, i.e., more than an order of magnitude smaller than the wing lift coefficient. The error in the pitching moment predictions for the  $\bar{C}/4$  location (Figure 2.12) represents a difference of about 2.5 % of  $\bar{C}$  on the location of the center of pressure at moderate angles of attack ( $\alpha < 5^\circ$ ) that is equivalent to about 1% of the maximum chord length of the wing. Another point worth noting is that the vortex lift was found to be many times smaller than the wing lift calculated by the vortex lattice method. Therefore, the approximate treatment of the vortex lift by the suction analogy is considered satisfactory in determining the net airload sum for the wing.

#### 2.9.4 Ground Effects

Analytical solutions that include the ground effects are obtainable by the method of images by assuming the ground plane to be perfectly flat and of infinite extent. Under these conditions, the boundary requirements for the flow at the ground plane are exactly satisfied by defining a wing image located directly below the wing at a distance equal to twice the altitude from the ground plane. For altitudes equal or greater than one chord length, the lifting line and the lifting surface analytical techniques provide comparable and accurate solutions to the problem. When the altitude from the ground plane is diminished below the one-chord length, the chordwise distribution of circulation is very strongly affected by the presence of the ground plane. In this range of altitudes, only the lifting surface methods such as the vortex lattice analysis technique can be expected to provide accurate solutions.

The accuracy of the present program for predicting ground effects may be demonstrated by comparing analytical solutions against lifting line predictions<sup>(25, 26)</sup> and experimental test results.<sup>(26)</sup> In accomplishing these objectives, ground effects were calculated for three different wing planforms for which comprehensive wind tunnel test and/or flight data are available. A comparison of results is shown in Figure 2.14. In examining the figure, the following observations are made:

- 1) For the rectangular wing planform of aspect ratio of six shown in the figure (Figure 2.14[A]), the program predictions of the ground effects are found to be in perfect agreement with the flight test

data<sup>(26)</sup> for the range of altitudes tested. As expected, the lifting line theory<sup>(25, 26)</sup> is inaccurate very near the ground plane ( $H/C \leq 1$ ).

- 2) For the straight tapered wing of aspect ratio of ten (Figure 2.14[B]), the program predictions are found in very good agreement with the experimental data obtained in the wind tunnel.<sup>(27)</sup> Again, at distances very near the ground plane, the lifting line theory<sup>(26)</sup> proves to be inaccurate. An illustration of the corresponding variation of the span lift distribution due to the ground effects is also shown in the figure.
- 3) For a delta wing of aspect ratio of 2.309 (Figure 2.14[C]), the present program predictions are compared with semi-empirical results reported by Fox.<sup>(28)</sup> The analytical predictions of the ground effects by the program are found not to be in very good agreement with these results. However, the accuracy of this data is suspected since the wing lift coefficient out-of-ground is found to be about 20 percent larger than reported by other investigators for comparable delta wing planforms operating at the same angle of attack<sup>(23, 24)</sup> (see Figure 2.10, Configuration C1).

#### 2.9.5 Wings of Unusual Planforms

Analytical predictions of the aerodynamic characteristics for wings having large sweepback angles and unusual planforms obtained by the present program and the lifting line theory<sup>(29, 30)</sup> are compared in Figures 2.15 and 2.16. In the first figure, the span loading distribution predictions for three different wing planforms of aspect ratio of six having continuous and broken sweepback of 45° at the 1/4 chord are presented. In all three cases good agreement is found between the vortex lattice and the lifting line predictions. Although the larger discrepancies are found at the root region, the small differences encountered in the span loading predictions are probably due to the greater accuracy of the vortex lattice method for representing the real problem. Predictions for the lift slope and the location of the center of pressure on the wing surface also shown in the figure are found to be in good agreement. In the second figure (Figure 2.16), predictions of the effect of varying the sweepback angle on the wing lift slope for straight tapered wings of aspect ratio of six are compared. Again, a comparison between the vortex lattice and lifting line solutions are found to be in good agreement.

## 2.9.6 Wings With Severe Surface Discontinuities

The accuracy of the present vortex lattice program for analyzing wing planforms having severe surface discontinuities is considered in this section. Such discontinuities arise from two sources: (1) sharp discontinuities in the wing surface such as: abrupt changes in the wing dihedral, the presence of wing-tip end plates, boundary layer flow fences, etc., and (2) trailing edge surface discontinuities arising from large deflections of control devices such as flaps or ailerons. The solutions for one example of each of these types of discontinuities is considered and compared against experimental results or other theoretical solutions.

### 1) Wing of Aspect Ratio of Four with End Plates

The exact analytical treatment of arbitrary wing planforms with end plates at the tip can only be performed using the exact geometry (no linearization) in prescribing the boundary conditions. The problem presents the most severe test for the analytical method because of the very large velocities induced in the spanwise directions by the end plate bound vortex filaments. Analytical predictions performed by the present program are compared with experimental results<sup>(31)</sup> for a rectangular wing of aspect ratio of four with large end plates in Figure 2.17. The analytical results showed a stronger effect of the end plates on the wing lift (about 30 percent larger) than obtained in the wind tunnel experiments. This discrepancy is probably due to the presence of separated flow in the corners of the wing-end plate junctures which would account for the loss of lift.

### 2) Straight Tapered Wing of Aspect Ratio of Six with Flapped Surfaces

A straight tapered wing of aspect ratio of six having simple trailing edge flapped surface of 25 percent of chord is considered. The flapped surfaces are assumed to be constituted by the wing flaps and the ailerons which extend from the root to the 62.5 percent and from the 62.5 percent wing station to the tip respectively (see Figure 2.18). Analytical solutions were obtained by the program for symmetric and unsymmetric span loadings. Symmetric span loadings were calculated for the wing operating with the flaps extended 30° and the ailerons neutral, and unsymmetric span loadings, by assuming unequal aileron

deflections of  $10^\circ$  down and  $15^\circ$  up for the left and right ailerons respectively. The handling of the flap-aileron junction surface discontinuity was treated using the smoothing procedure described in Section 2.7 using  $\delta/(b/2)$  value of 0.20. A summary of the principal results obtained were plotted using the program standard plotting option and are presented in Figure 2.18. A comparison between the results obtained and the lifting line and thin airfoil theory analytical predictions<sup>(9)</sup> are presented in Table 2.05. As shown in the table, the vortex lattice method predictions for the airload increments due to the flapped surface deflections are found to be smaller than by the other method. The discrepancies in the results probably are due to the fact that in the present vortex lattice method the exact geometry of the wing section camber distributions are considered while for the other method (thin airfoil theory) approximate geometric boundary conditions (which are valid only at very small flapped surface deflections) are used. The fact that the vortex lattice predictions for the wing airloads increments are smaller is a most revealing result. Note that solutions obtained based on thin airfoil theory usually overestimate the effect of the flapped surfaces by about 20 percent.

#### 2.9.7 Multiple-Surface Configurations

The accuracy of the present vortex-lattice analysis program in obtaining solutions for vehicle configurations that are represented by two or more lifting surfaces is to be evaluated in this section. Typical example configurations under this category are: wing + horizontal tail (2 surfaces), wing + canard control surface (2 surfaces), thick wing (2 surfaces), wing + horizontal tail + vertical tail + fuselage (4 surfaces), lifting body (2 or more surfaces), etc. The significant characteristic of the multiple-surface problem is the mutual influence or interference effect that each surface exerts on all the other surfaces. Such problems can only be properly analyzed by the vortex-lattice and surface-integral<sup>(7)</sup> methods. In determining the accuracy of the present analysis, analytical predictions were performed for three representative vehicle configurations for which wind-tunnel or flight data of sufficient quantity and accuracy is available. The results obtained, a comparison between analytical predictions versus experimental data, are presented in Figures 2.19 through 2.21. The vehicle con-

figurations and type of experimental data sources studied were as follows: 1) out-of-ground wind tunnel tests conducted for a wing + canard surface + slender fuselage model in Reference 32, 2) flight test data in and out of ground conducted for the Douglas F5D-1 prototype airplane with a modified ogee wing,<sup>(33)</sup> and 3) flight test data in- and out-of-ground for the North American XB-70 Airplane.<sup>(33)</sup> In examining the comparisons presented in the figures, it must be concluded that the present vortex-lattice analysis method is capable of predicting the aerodynamic loads within a few percent (1 percent to 5 percent) of the experimental results. The details of the technical evaluation that led to this conclusion are discussed below.

1) Out-of-Ground Predictions

Analytical predictions for lift, induced drag, and pitching moment for the wing-canard-fuselage model are compared against wind tunnel test results in Figure 2.19. The predictions for the lift coefficient are found to be in remarkable agreement with the test data, i.e., within one percent. This result was obtained notwithstanding of the very strong mutual interference effect that the canard surface exerts on the wing that is predicted by the analysis (see Table 2.06). The induced drag predictions are also found to be in very good agreement with the test data, especially if it is taken into account the fact that the magnitude of the induced drag force is much smaller (by a factor of  $\sim 10$ ) in comparison with the lift force. Similarly, comparisons for the pitching moment are given about the C.G. and the trailing-edge of the wing root chord. Although a very large discrepancy is found between the predicted and the test data for the pitching moment when expressed about the C.G., the scale of the pitching moment here is very small and misleading. By expressing the pitching moment about the aftermost location of the wing surface, the trailing-edge of the wing root chord, a more meaningful evaluation of results is possible. This fact can be corroborated by calculating the discrepancy of the location of the center of pressure that reveals the cause for the discrepancy in the pitching moment. Accordingly, the predicted location of the center of pressure when compared against the test data is off by about ten percent of the wing  $\bar{C}$ , or, about three percent of the

model length. Since varying the vortex-lattice arrangement or the number of control points showed no significant change on the predictions, it is concluded that the analytical predictions represent an exact solution. Then, the small discrepancy encountered in the pitching moment (Figure 2.19d) or center of pressure location can only be attributed to wind tunnel test measurement errors or to the fact that the exact geometry of the wind tunnel model was only approximately represented by the vortex-lattice arrangement used in carrying out the calculations of analytical predictions.

2) In-Ground-Predictions

Analytical predictions for the lift of full-size vehicles in flight in the presence or absence of a very near ground plane are compared against flight test data<sup>(34)</sup> in Figures 2.20 and 2.21. In general, relative good agreement is found between the analytical predictions and the flight test data. Although better agreement is found for the out-of-ground comparisons, this finding is not surprising when considering the great difficulties encountered in obtaining accurate data very near the ground plane. Corrections on the lift due to varying control surface deflections, jet thrust, etc., that include the ground effect are difficult to assess and are generally ignored.

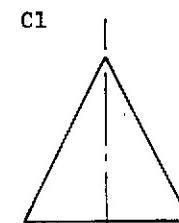
TABLE 2.01 - VORTEX-LATTICE GEOMETRY EFFECT ON THE CALCULATED WING AIRLOADS (PROGRAM HA010B)  
FOR A DELTA WING OF ASPECT RATIO = 2, OPERATING AT  $\alpha = 10^\circ$  AND  $M = 0.25$

VORTEX MATRIX GEOMETRY					WITH L. E. SUCTION (BLUNT L. E.)			NO L. E. SUCTION (SHARP L. E.)			EXECUTION TIME
NO. SPAN ELEMENTS	SPAN SPACING†	NO. CHORD ELEMENTS	CHORD SPACING†	TOTAL NO. ELEMENTS	$C_L$	$C_{D_i}$	$C_M(\bar{C}/4)$	$C_L$	$C_{D_i}$	$C_M(\bar{C}/4)$	SECONDS‡
1	14	0	5	70	0.3708	0.0476	-0.0825	0.4071	0.0722	-0.0882	39
2	14	1	5	70	0.3765	0.0472	-0.0845	0.4149	0.0735	-0.0905	38
3	14	0	5	70	0.3717	0.0488	-0.0801	0.4074	0.0729	-0.0860	39
4	14	1	5	70	0.3770	0.0478	-0.0830	0.4152	0.0739	-0.0890	39
5	20	0	5	100	0.3739	0.0486	-0.0827	0.4098	0.0729	-0.0885	73
6	20	1	5	100	0.3765	0.0483	-0.0843	0.4141	0.0734	-0.0904	73
7	20	1	5	100	0.3772	0.0495	-0.0818	0.4137	0.0738	-0.0881	74
8	14	1	9	136	0.3752	0.0477	-0.0837	0.4127	0.0733	-0.0895	106

†LEGEND

1 = COSINE SPACING  
0 = CONSTANT SPACING

‡EXECUTION TIME INCLUDES  
LINEAR ARRAY SOLUTIONS



$$AR = 2$$

$$TR = 0$$

$$\Lambda_{\bar{C}/4} = 56^\circ$$

TABLE 2.02 - VORTEX-LATTICE CONTROL POINT LOCATION EFFECT ON THE CALCULATED WING AIRLOADS (PROGRAM HA010B)  
FOR A DELTA WING OF ASPECT RATIO = 2, OPERATING AT  $\alpha = 10^\circ$  AND  $M = 0.25$

LOCATION OF CONTROL POINT % OF ELEMENT CHORD		75%	80%	83%	77%
VORTEX MATRIX GEOMETRY	NO. SPAN ELEMENTS	14	14	14	14
	SPAN SPACING†	1	1	1	0
	NO. CHORD ELEMENTS	5	5	5	5
	CHORD SPACING†	0	0	0	0
WITH L. E. SUCTION (BLUNT L. E.)	$C_L$	0.3673	0.3908	0.4044	0.3708
	$C_{D_i}$	0.0462	0.0527	0.0568	0.0476
	$C_M(\bar{C}/4)$	-0.0846	-0.0838	-0.0823	-0.0825
NO L. E. SUCTION (SHARP L. E.)	$C_L$	0.4051	0.4359	0.4602	0.4071
	$C_{D_i}$	0.0714	0.0769	0.0812	0.0722
	$C_M(\bar{C}/4)$	-0.0903	-0.0892	-0.0885	-0.0882

†LEGEND

1 = COSINE SPACING

0 = CONSTANT SPACING

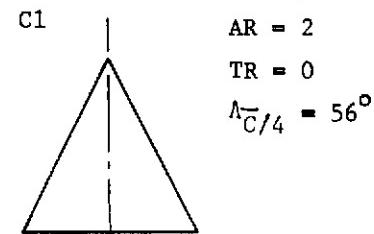


TABLE 2.03 - WING AIRLOAD PREDICTION COMPARISONS FOR WING PLANFORMS OF MODERATE ASPECT RATIO

ANALYSIS	PLANFORM	GEOMETRY			AERO COEFFICIENTS AT $\alpha = 10^\circ$ , $M = 0$				
		ASPECT RATIO	TAPER RATIO	SWEEP $A(\bar{C}/4)$	$C_L$	$C_M(\bar{C}/4)$	$C_{D_i}$	WING LIFT SLOPE $C_L/\text{DEG}$	WING A. C. % $\bar{C}$
TRW VORTEX-LATTICE METHOD (PROGRAM HA010B) CONTROL POINT AT 75%	RECTANGULAR	6	1	0	0.7567	0.0004	0.0355	0.07567	24.99
	TAPERED	6	1/3	0	0.7795	0.0031	0.0367	0.07795	24.59
	ELLIPTICAL	6.04	0	0	0.7865	-0.0211	0.0377	0.07865	27.71
NACA REPORT NO. 631 <sup>(18)</sup> SECTION LIFT SLOPE $a_0 = 2\pi \times 57.3$	RECTANGULAR	6	1	0	0.7870	0	0.0345	0.07870	25.00
	TAPERED	6	1/3	0	0.8195	0	0.0363	0.08195	25.00
	ELLIPTICAL	6	0	0	0.8220	0	0.0358	0.08220	25.00
TRW VORTEX-LATTICE METHOD (PROGRAM HA010B) CONTROL POINT AT 77%	RECTANGULAR	6	1	0	0.7779	0.0068	0.0373	0.07779	24.12
	TAPERED	6	1/3	0	0.8011	0.0097	0.0387	0.08011	23.78
	ELLIPTICAL	6.04	0	0	0.8081	-0.0149	0.0398	0.08081	26.84
NACA REPORT NO. 631 <sup>(18)</sup> SECTION LIFT SLOPE $a_0 = 0.099$ (NACA0012 AIRFOIL)	RECTANGULAR	6	1	0	0.7286	0.0044	0.0295	0.07286	24.40
	TAPERED	6	1/3	0	0.7564	0.0045	0.0307	0.07564	24.40
	ELLIPTICAL	6	0	0	0.7610	0.0046	0.0307	0.07610	24.40

TABLE 2.04 - WING AIRLOAD PREDICTION COMPARISONS FOR WING PLANFORMS OF MODERATE ASPECT RATIO AT  $\alpha = 5^0$

CONFIGURATION					TEST CONDITIONS		ANALYSIS <sup>†</sup> (PROGRAM HAD10B)		EXPERIMENT	WING AIRLOAD COEFFICIENTS			C. P. LOCATION
PLANFORM	ASPECT RATIO	TAPER RATIO	SWEET ANGLE $\Lambda(\bar{C}/4)$	AIRFOIL SECTION	MACH NUMBER	REYNOLDS NUMBER	WITH L. E. SUCTION (BLUNT L. E.)	NO L. E. SUCTION (SHARP L. E.)	NACA RM A53A30	$c_L$	$c_{D_i}$	$c_M(\bar{C}/4)$	$z \bar{C}$
DELTA	2	0	56.0°	NACA 0003-63	0.25	$16.6 \times 10^6$	X			0.1849	0.0193	-0.0423	47.87
								X		0.1941	0.0248	-0.0435	47.41
									X	0.1830	0.0165	-0.0333	43.19
DELTA	3	0	45.0°	NACA 0003-63	0.25	$10.6 \times 10^6$	X			0.2433	0.0210	-0.0412	41.93
								X		0.2547	0.0304	-0.0422	41.56
									X	0.2390	0.0200	-0.0332	38.89
DELTA	4	0	37.0°	3% THICK ROUNDED NOSE SECTION	0.25	$9.1 \times 10^6$	X			0.2893	0.0215	-0.0384	38.27
								X		0.3029	0.0348	-0.0391	37.90
									X	0.2830	0.0255	-0.0299	35.56
TAPERED	3.08	0.39	11.5°	3% THICK BICONVEX SECTION	0.25	$8.3 \times 10^6$	X			0.3104	0.0216	-0.0007	25.22
								X		0.3214	0.0362	+0.0023	24.28
									X	0.2860	0.0278	+0.0121	20.76
TAPERED	3	0.40	40.6°	3% THICK BICONVEX SECTION	0.25	$8.4 \times 10^6$	X			0.2615	0.0213	-0.0203	32.76
								X		0.2722	0.0319	-0.0186	31.83
									X	0.2710	0.0275	-0.0175	31.45
RECTANGULAR	2	1.0	0°	3% THICK BICONVEX SECTION	0.61	$4.4 \times 10^6$	X			0.3000	0.0254	0.0000	25.00
								X		0.3109	0.0352	+0.0031	24.00
									X	0.2650	0.0271	+0.0150	19.339
CLIPPED DELTA	2	0.33	37.0°	3/8 THICK BICONVEX SECTION	0.61	$4.8 \times 10^6$	X			0.2800	0.0295	-0.0226	33.07
								X		0.2918	0.0336	-0.0204	31.99
									X	0.2600	0.0310	-0.0161	31.92

<sup>†</sup>COLOCATION POINT LOCATION AT 77% OF ELEMENT CHORD  
AND  $c_{d_0} = 0.007$  WERE USED IN THE ANALYSIS.

TABLE 2.05 - COMPARISON OF CALCULATED AIRLOAD COEFFICIENT INCREMENTS DUE TO FLAP DEFLECTION  
FOR A 25% OF CHORD FLAPPED SURFACE

SECTION COEFFICIENT INCREMENTS PER DEGREE OF FLAP DEFLECTION AT $Y/(b/2) = 0.40$				
	$\Delta c_L/\delta_f^{\circ}$	$\Delta c_m(C/4)/\delta_f^{\circ}$	$\Delta c_n/\delta_f^{\circ}$	$\Delta c_h/\delta_f^{\circ}$
VORTEX LATTICE METHOD (PROGRAM HA010B)	0.040	-0.01166	0.0566	-0.0140
LIFTING LINE THEORY (WAKE II PROGRAM <sup>(9)</sup> )	0.0672	-0.01138	0.0487	-0.0164

Note: The results presented were calculated for a 25% chord flap deflected 30° with the wing operating at zero angle of attack (See Figure 2.18).

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TABLE 2.06 - MULTIPLE-LIFTING-SURFACES INTERFERENCE EFFECT PREDICTIONS (HA0010B)  
FOR A SELECTED WING-CANARD-FUSELAGE CONFIGURATION (SEE FIGURE 2.19)

WING LIFT COEFFICIENT $C_{L_{\pi}}$ BASED ON $S_{\pi}$ AND $\alpha = 12.5^{\circ}$					
COMMENT	WING $S_{\pi} = 694.18$	CANARD $S_{\pi} = 113.04$	CENTER FUS $S_{\pi} = 17.53$	FUS NOSE $S_{\pi} = 26.44$	SUM AT C.G. $S_{\pi} = 694.18$
WING ALONE	0.7091				0.7091
CANARD ALONE		0.5214			0.0849
WING + CANARD	0.6694	0.4129			0.7366
WING + CANARD + FUS	0.6539	0.3982	0.1420	0.1420	0.7318

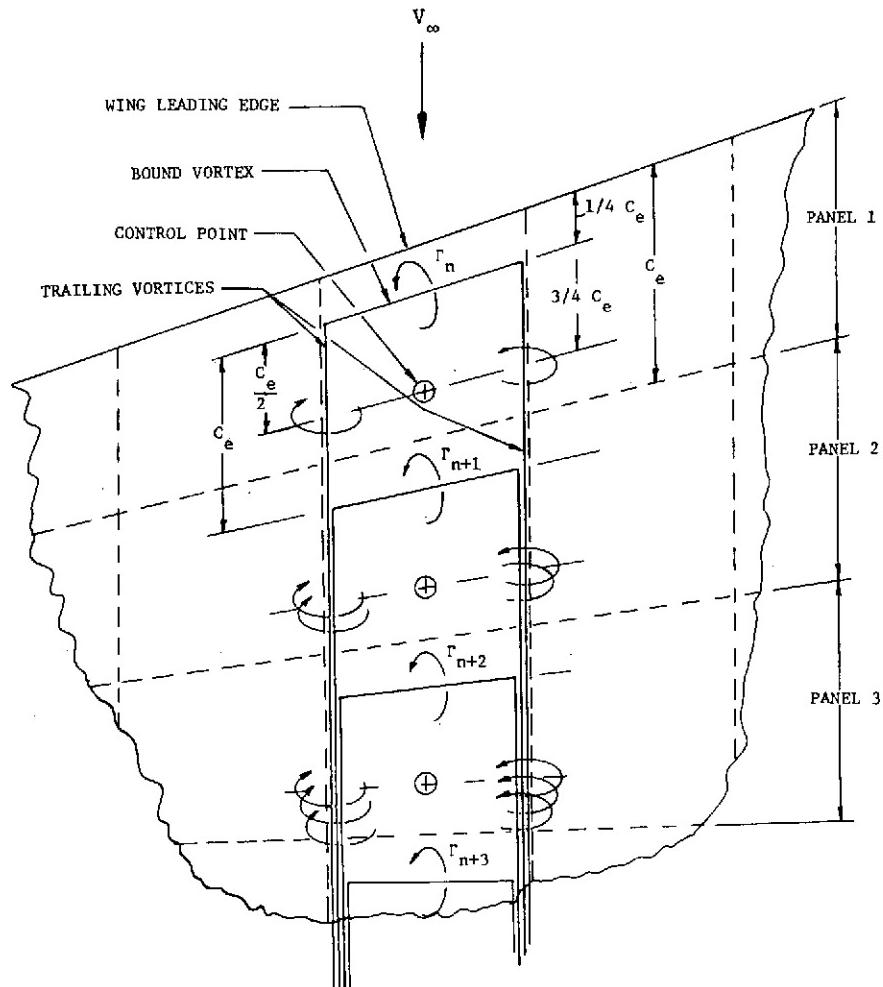


FIGURE 2.01 - SKETCH OF A CHORDWISE ROW OF VORTICES

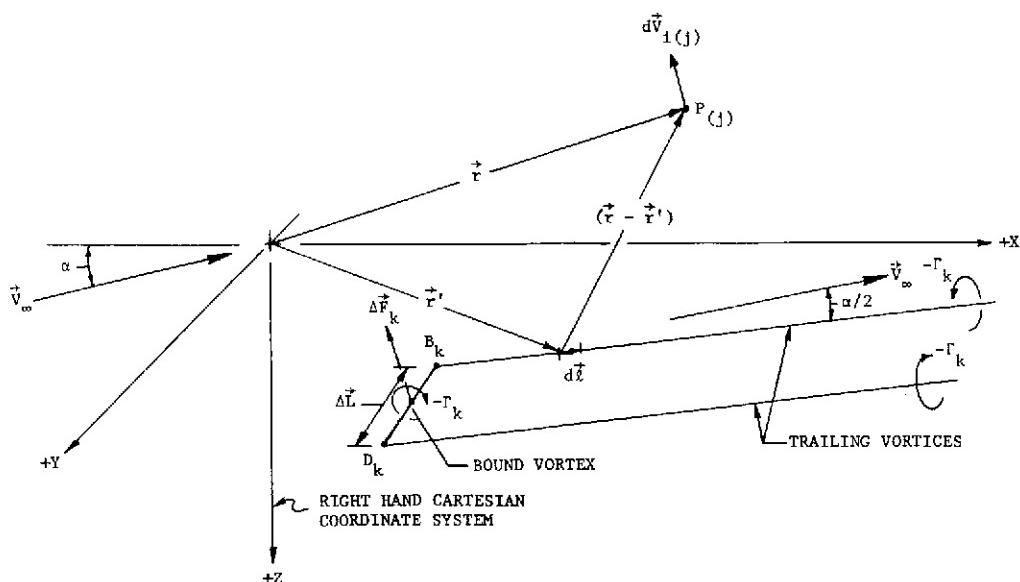


FIGURE 2.02 - GEOMETRY CONVENTION FOR A SKEW-SHAPED HORSESHOE VORTEX FILAMENT IN THE GENERAL COORDINATE SYSTEM

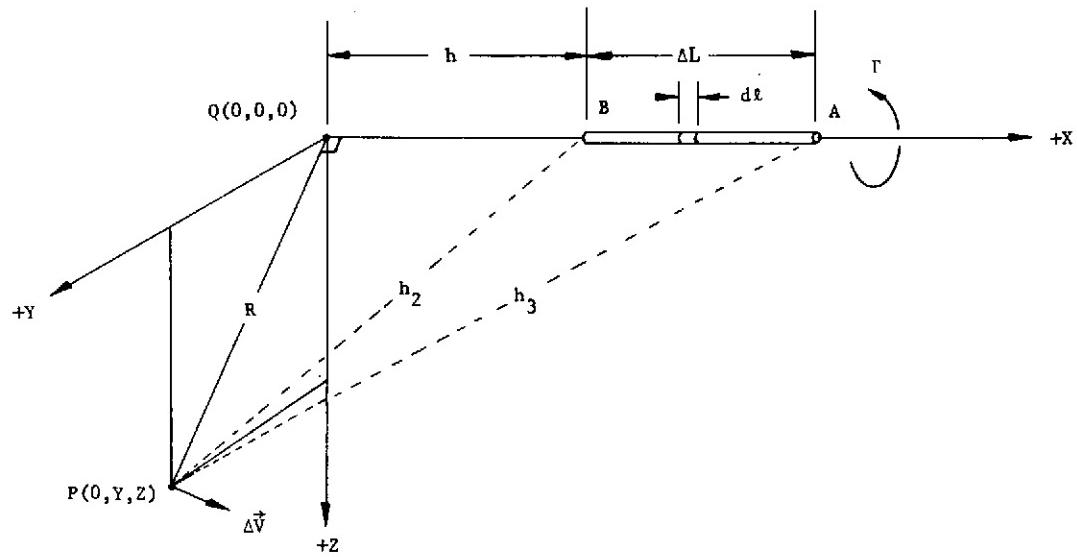


FIGURE 2.03 - VELOCITY INDUCED BY AN ELEMENTAL VORTEX FILAMENT OF LENGTH  $\Delta L$  DEFINED IN A LOCALIZED COORDINATE SYSTEM

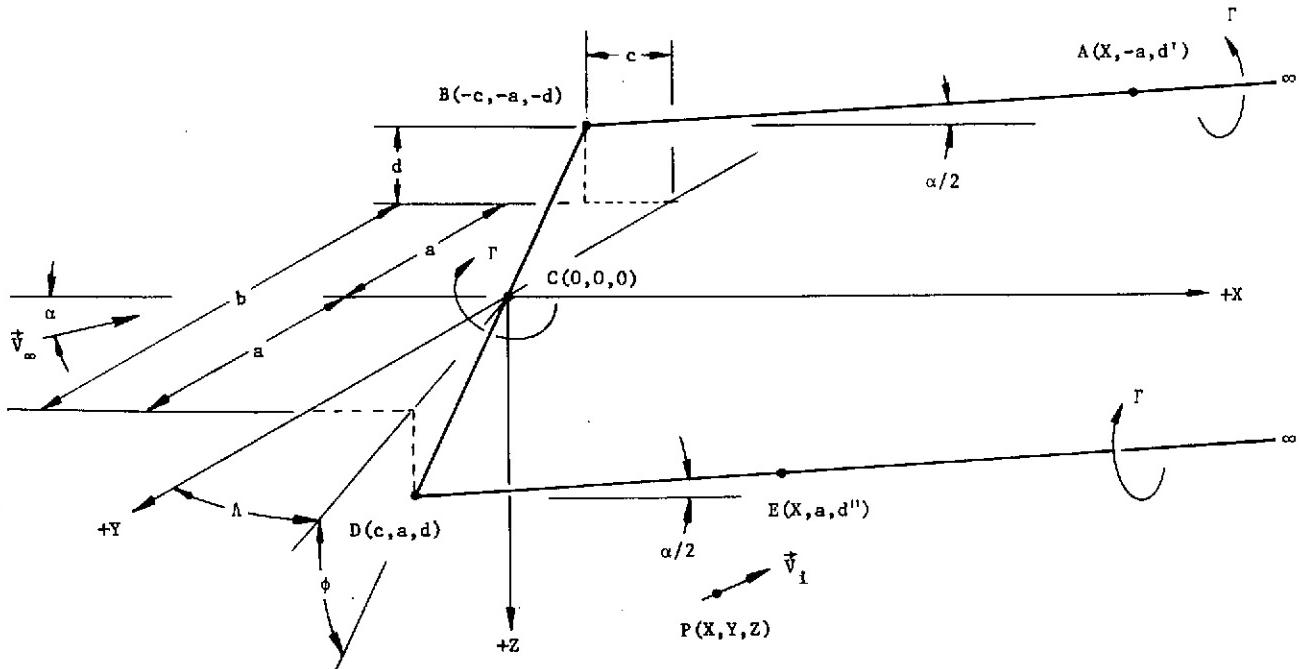


FIGURE 2.04 - GEOMETRY CONVENTION FOR A SKEW-SHAPED HORSESHOE VORTEX FILAMENT DEFINED IN THE LOCAL COORDINATE SYSTEM

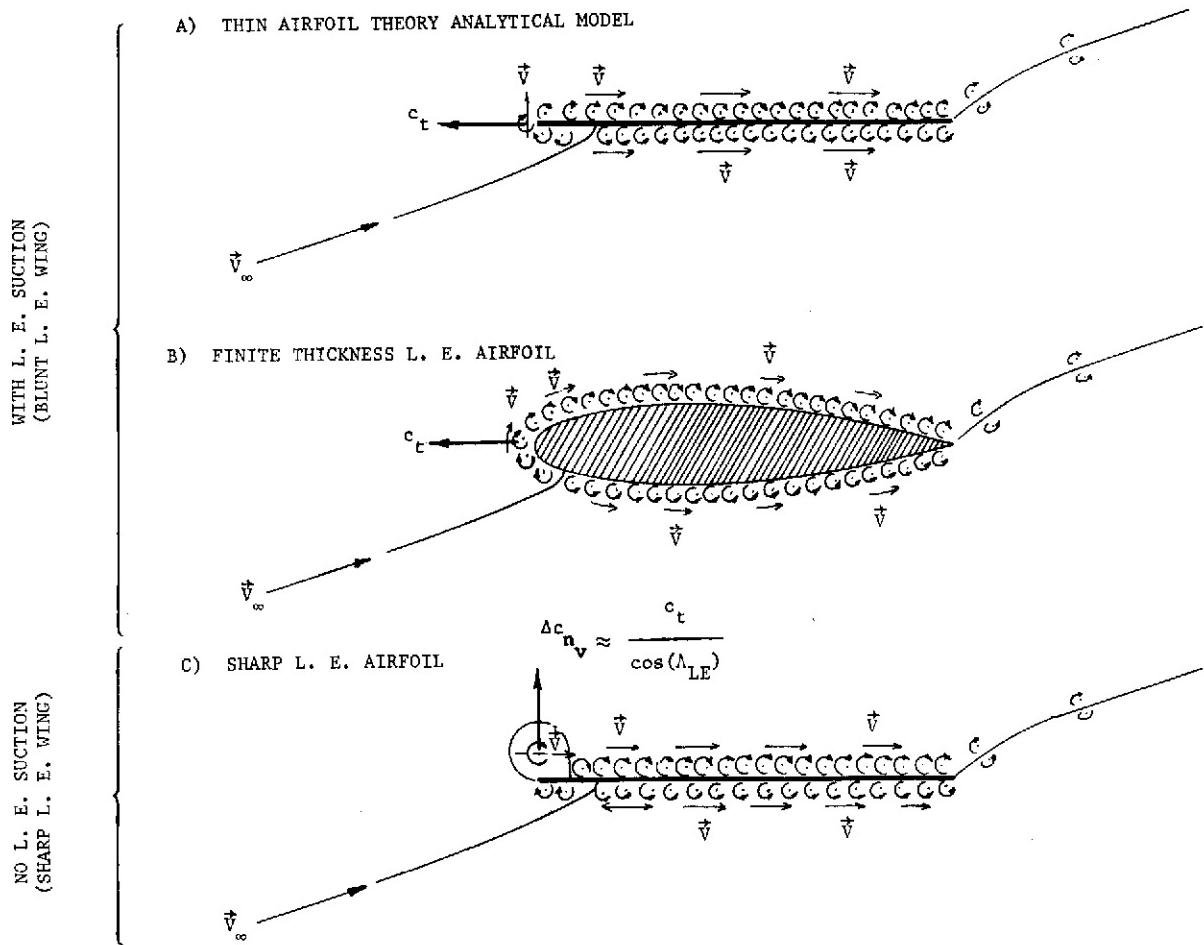


FIGURE 2.05 - ILLUSTRATION OF THE ORIGINS OF THE VORTEX LIFT

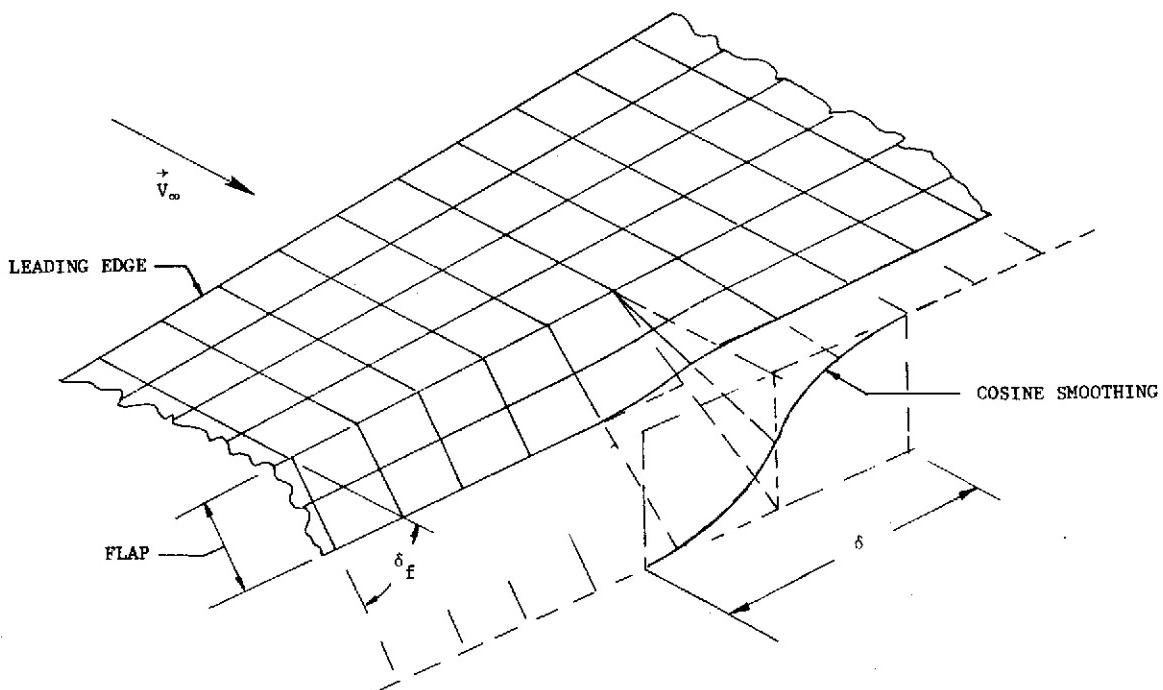
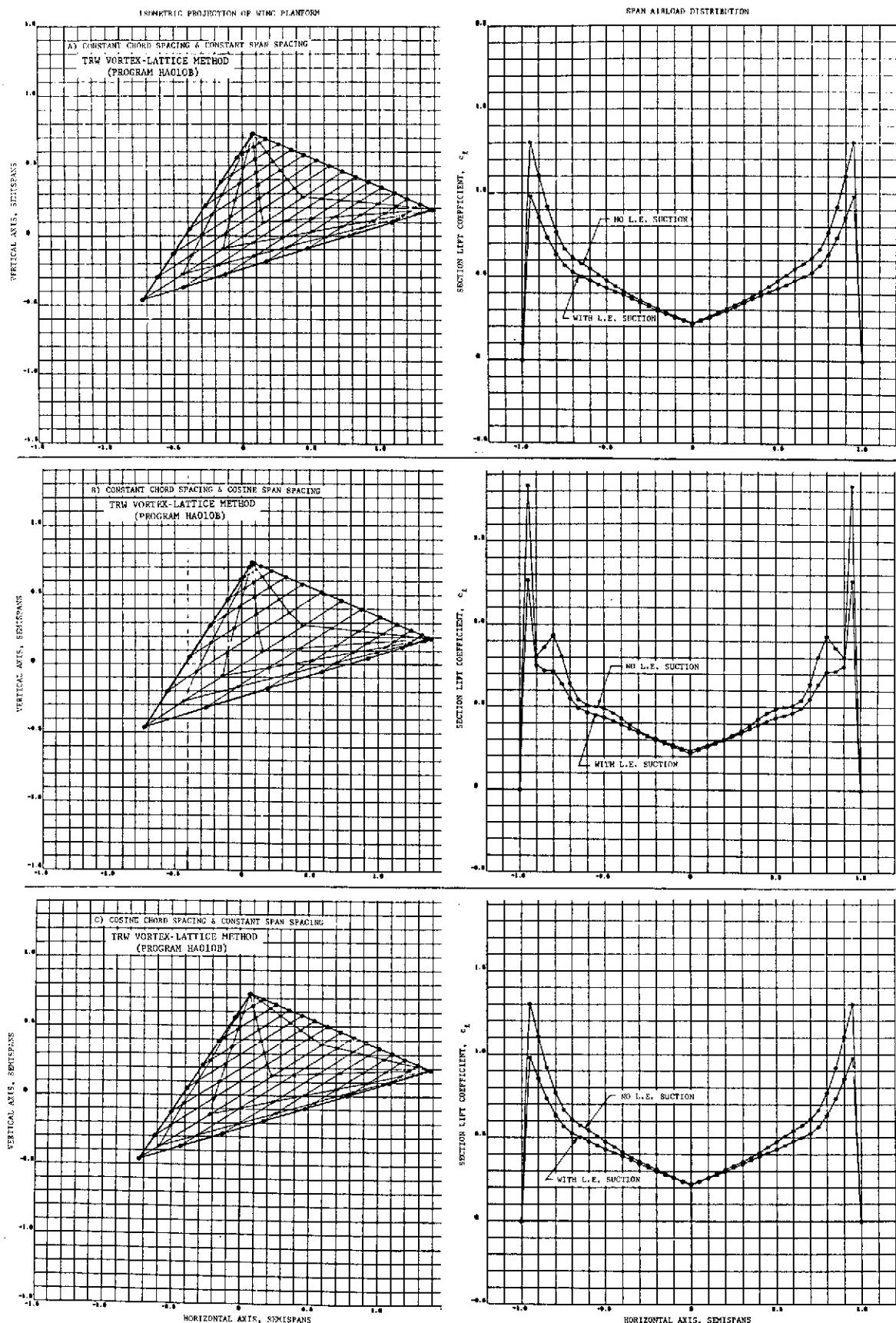


FIGURE 2.06 - COSINE SMOOTHING OF SHARP SURFACE-DISCONTINUITIES



**FIGURE 2.07 - VARIATION OF VORTEX-LATTICE ARRANGEMENT EFFECT ON THE SPAN SECTION LIFT DISTRIBUTION FOR A DELTA WING OF ASPECT RATIO = 2 AT AN ANGLE OF ATTACK  $\alpha = 10^\circ$**

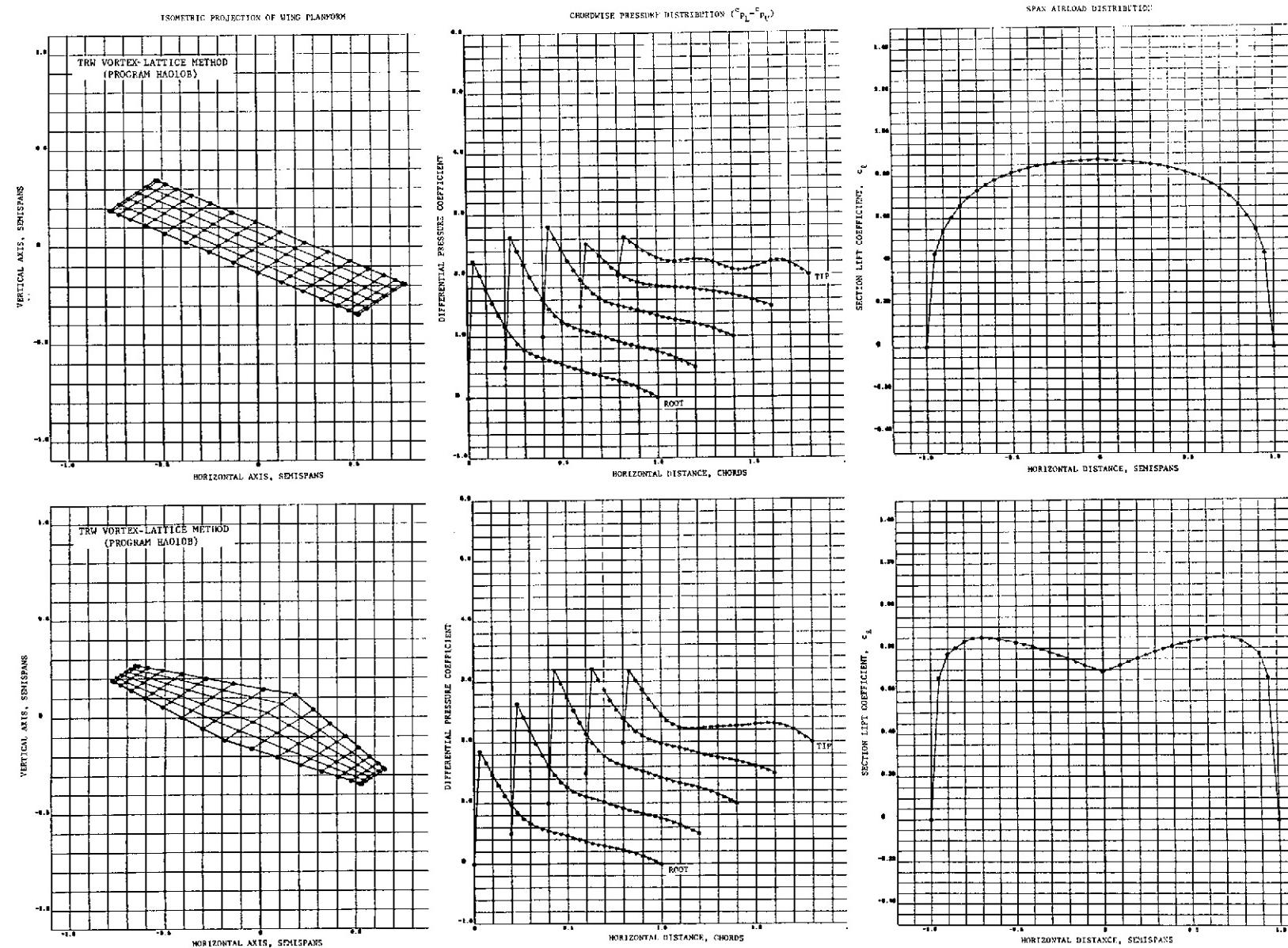


FIGURE 2.08 - LIFT DISTRIBUTION PREDICTIONS (PROGRAM HA010B) FOR FOUR BASIC WING PLANFORMS  
AT AN ANGLE OF ATTACK  $\alpha = 10^\circ$

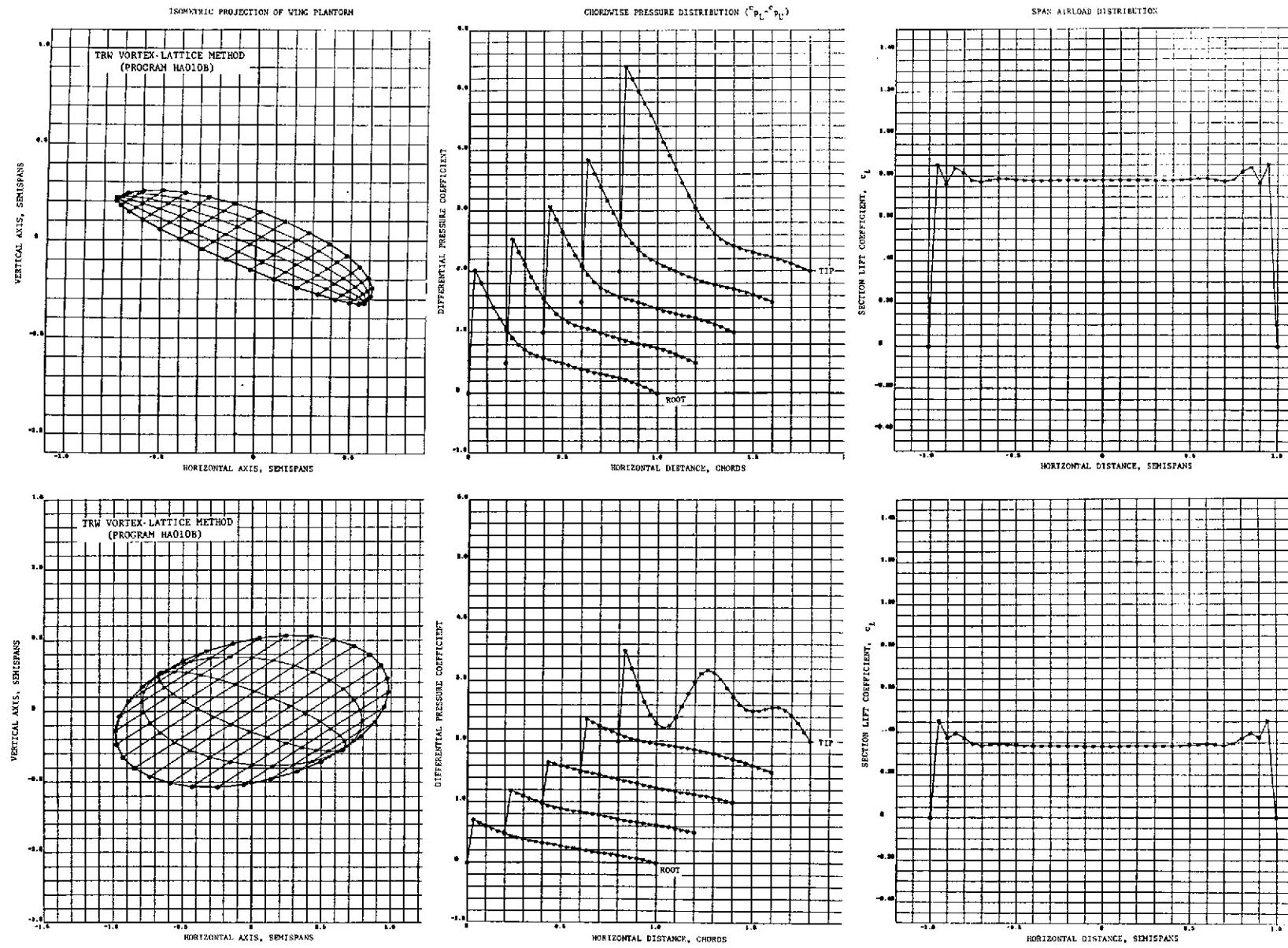
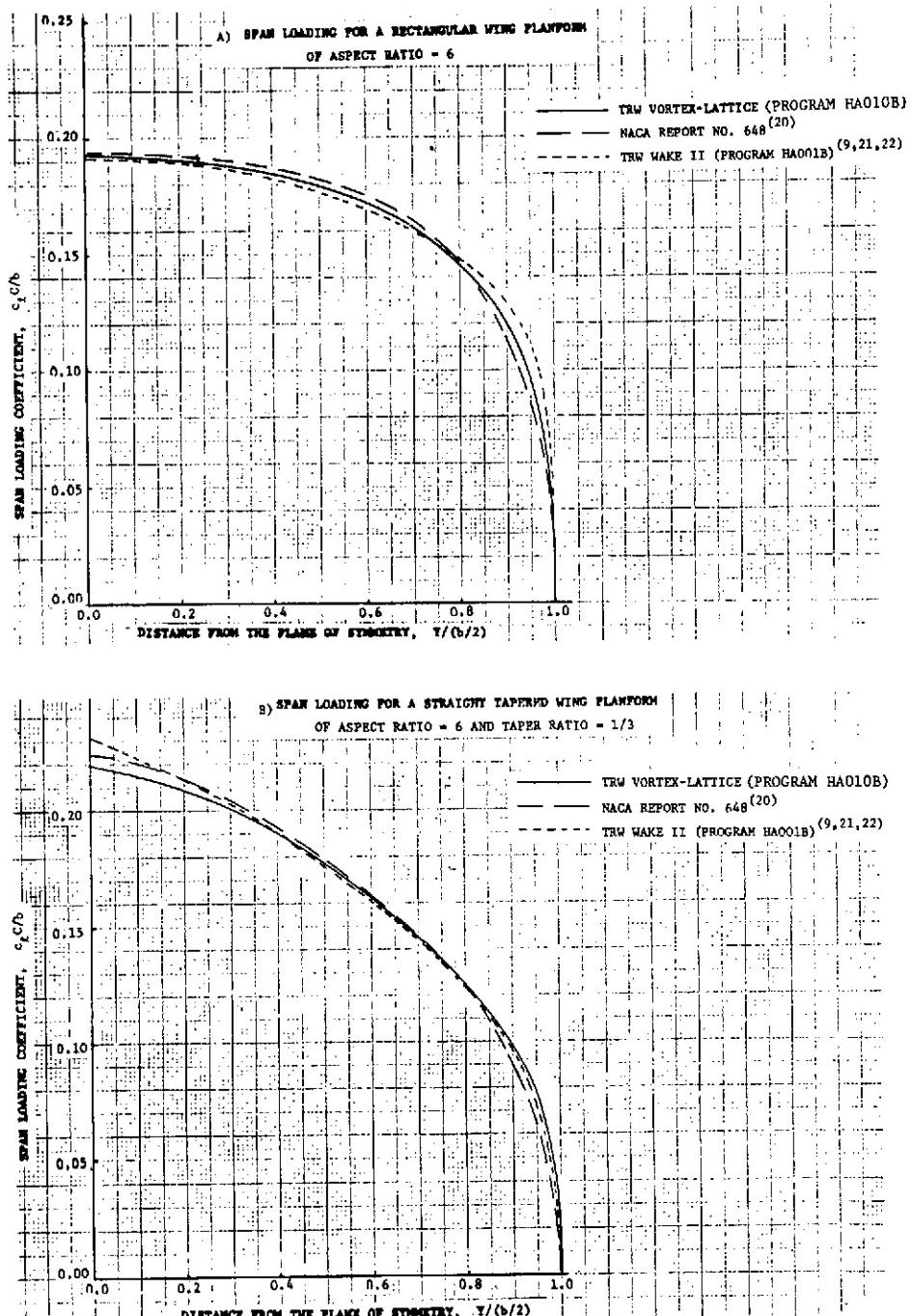


FIGURE 2.08 - LIFT DISTRIBUTION PREDICTIONS (PROGRAM HA010B) FOR FOUR BASIC WING PLANFORMS  
AT AN ANGLE OF ATTACK  $\alpha = 10^\circ$ , CONTINUED



**FIGURE 2.09 - SPAN LOADING PREDICTION COMPARISONS FOR TWO BASIC WING PLANFORMS  
OF ASPECT RATIO = 2**

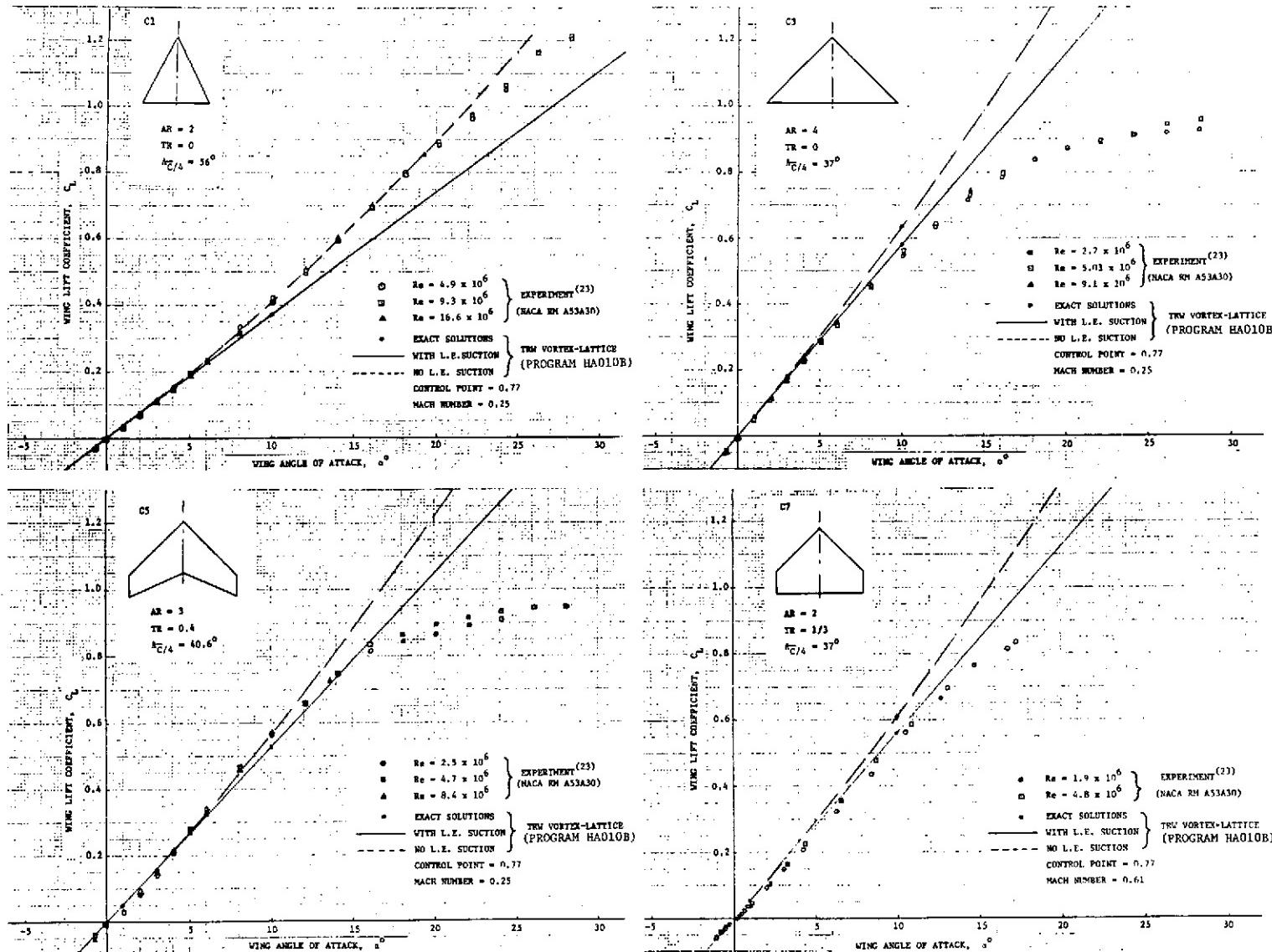


FIGURE 2.10 - WING LIFT PREDICTION COMPARISONS FOR SELECTED LOW ASPECT RATIO WING PLANFORMS

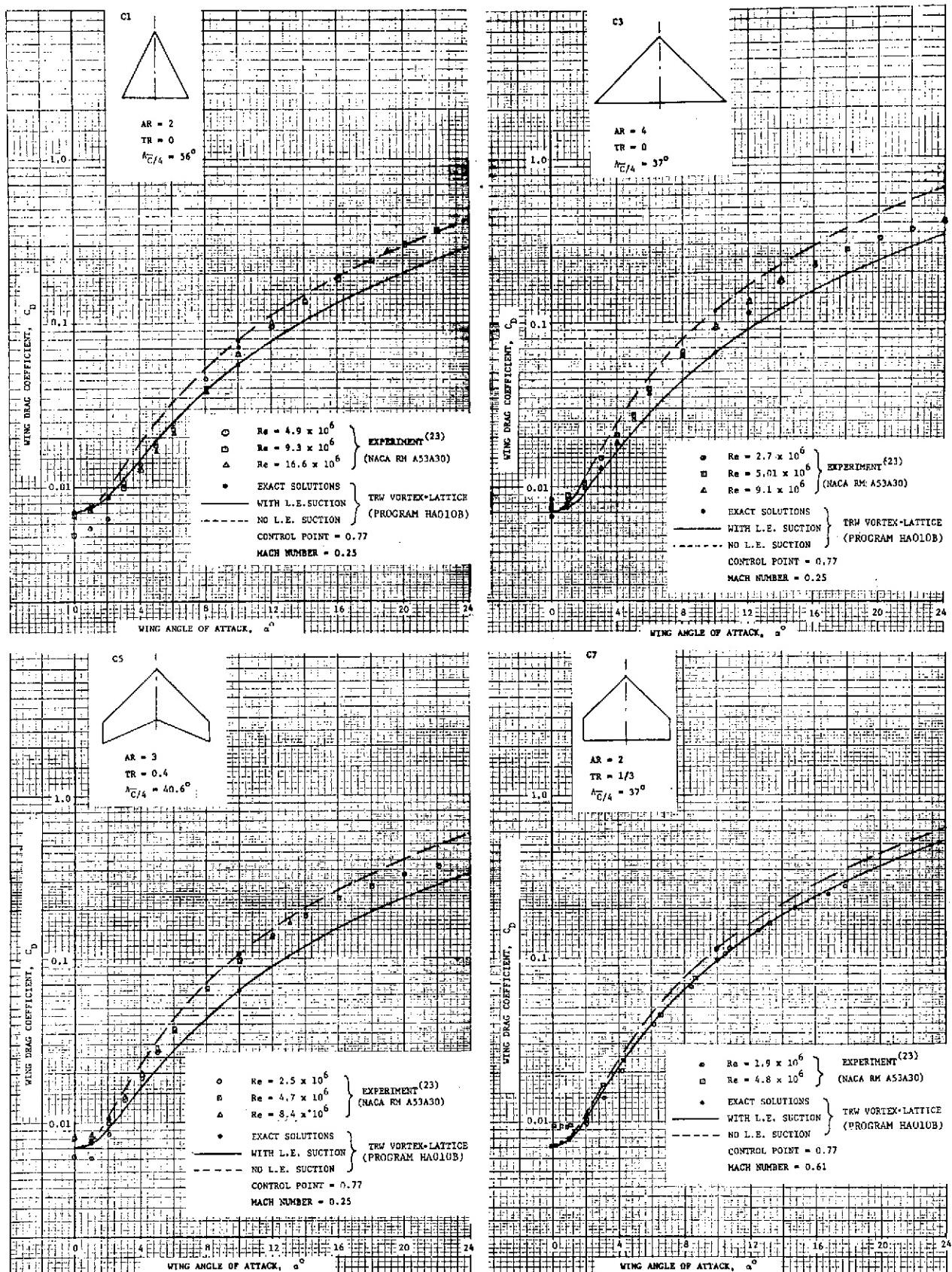
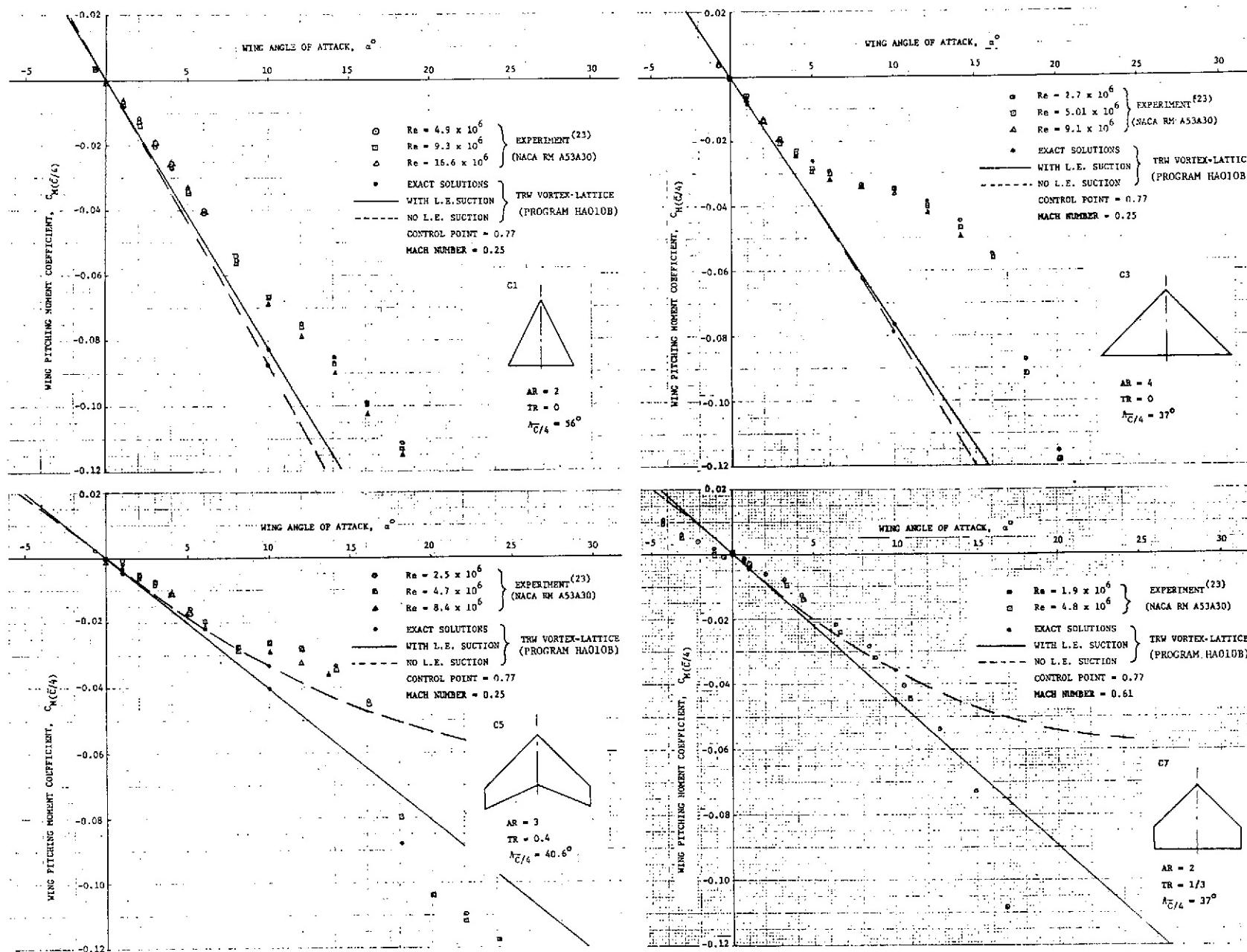


FIGURE 2.11 - INDUCED DRAG PREDICTION COMPARISONS FOR SELECTED LOW ASPECT RATIO WING PLANFORMS

FIGURE 2.12 - PITCHING MOMENT ABOUT  $\bar{C}/4$  PREDICTION COMPARISONS FOR SELECTED LOW ASPECT RATIO WING PLANFORMS

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OF POOR QUALITY

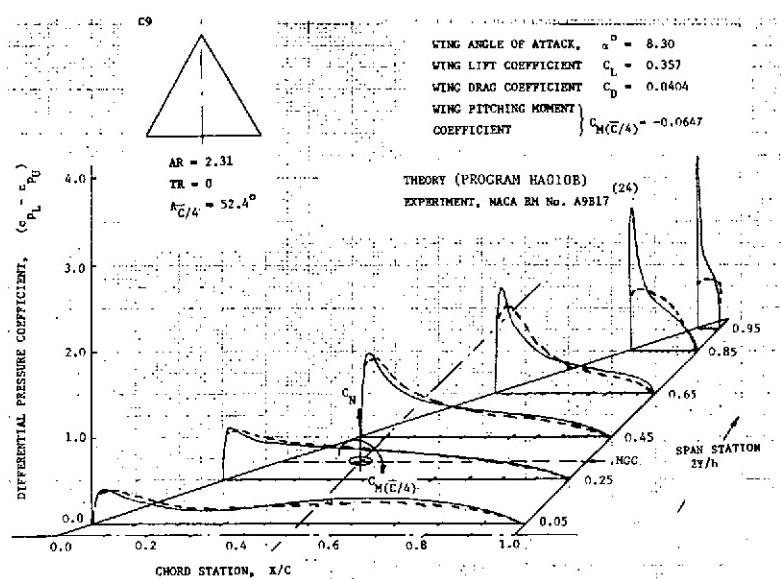
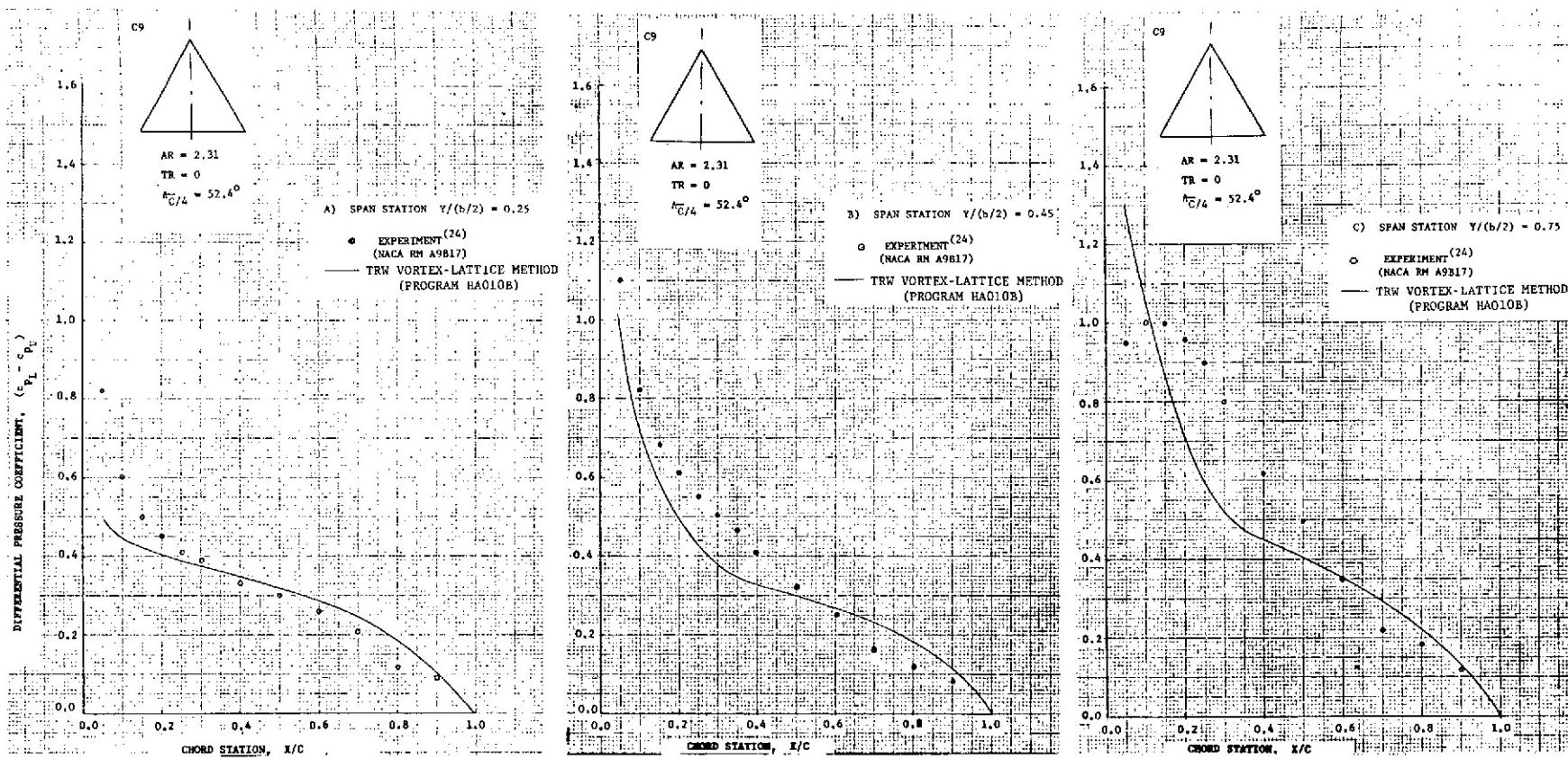


FIGURE 2.13 - LIFT DISTRIBUTION COMPARISONS FOR A DELTA WING  
OF ASPECT RATIO = 2 OPERATING AT AN ANGLE OF ATTACK  $\alpha = 8.30^\circ$

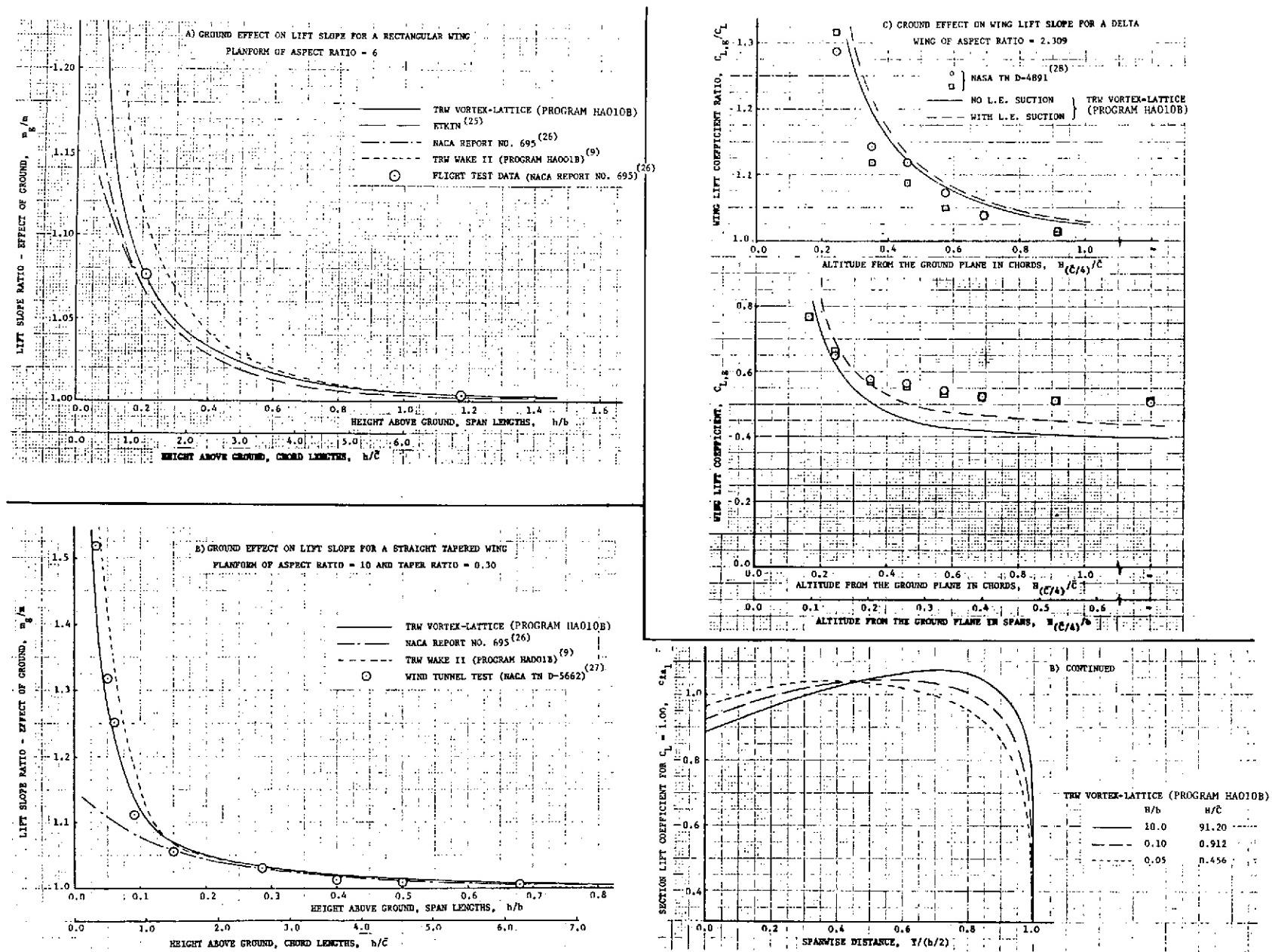


FIGURE 2.14 - WING LIFT PREDICTION COMPARISONS IN THE PRESENCE OF A VERY NEAR GROUND PLANE

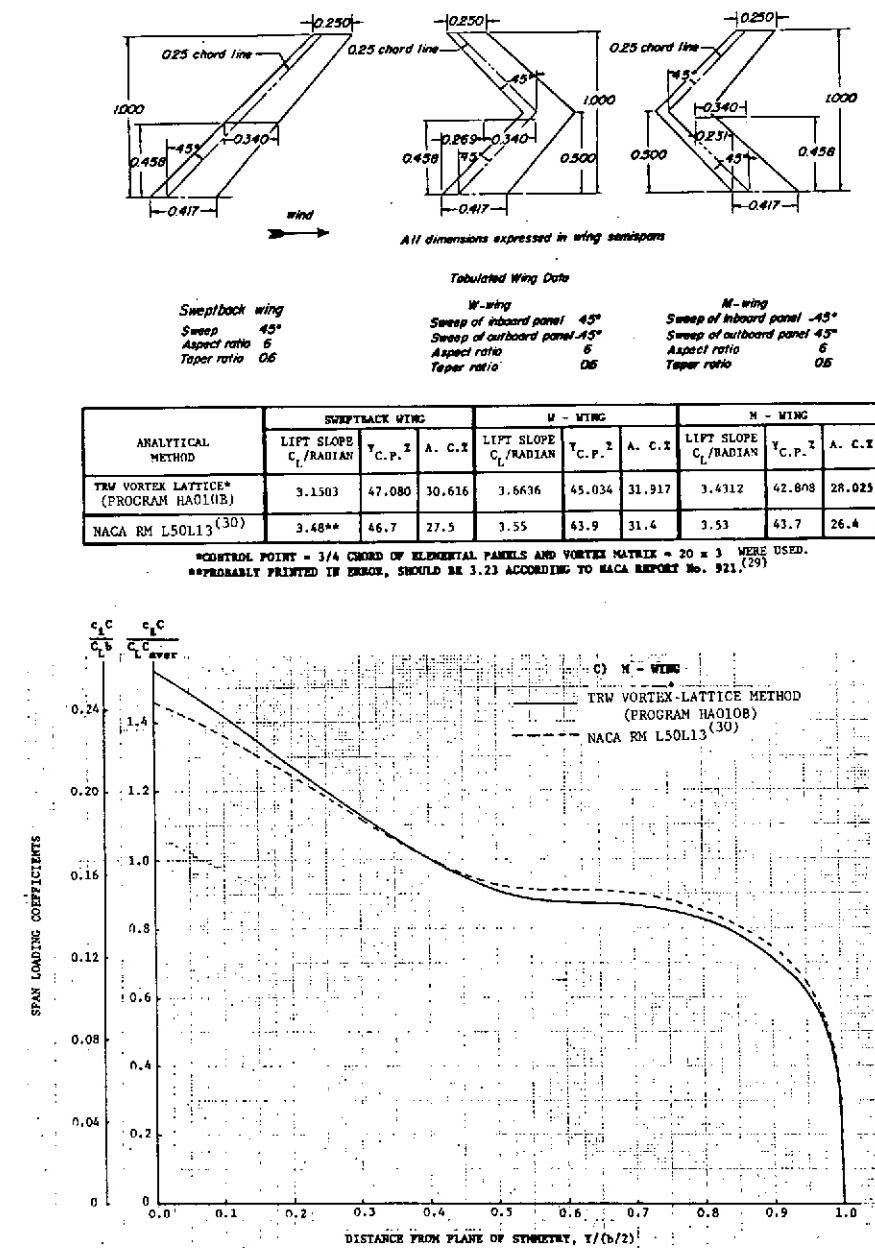
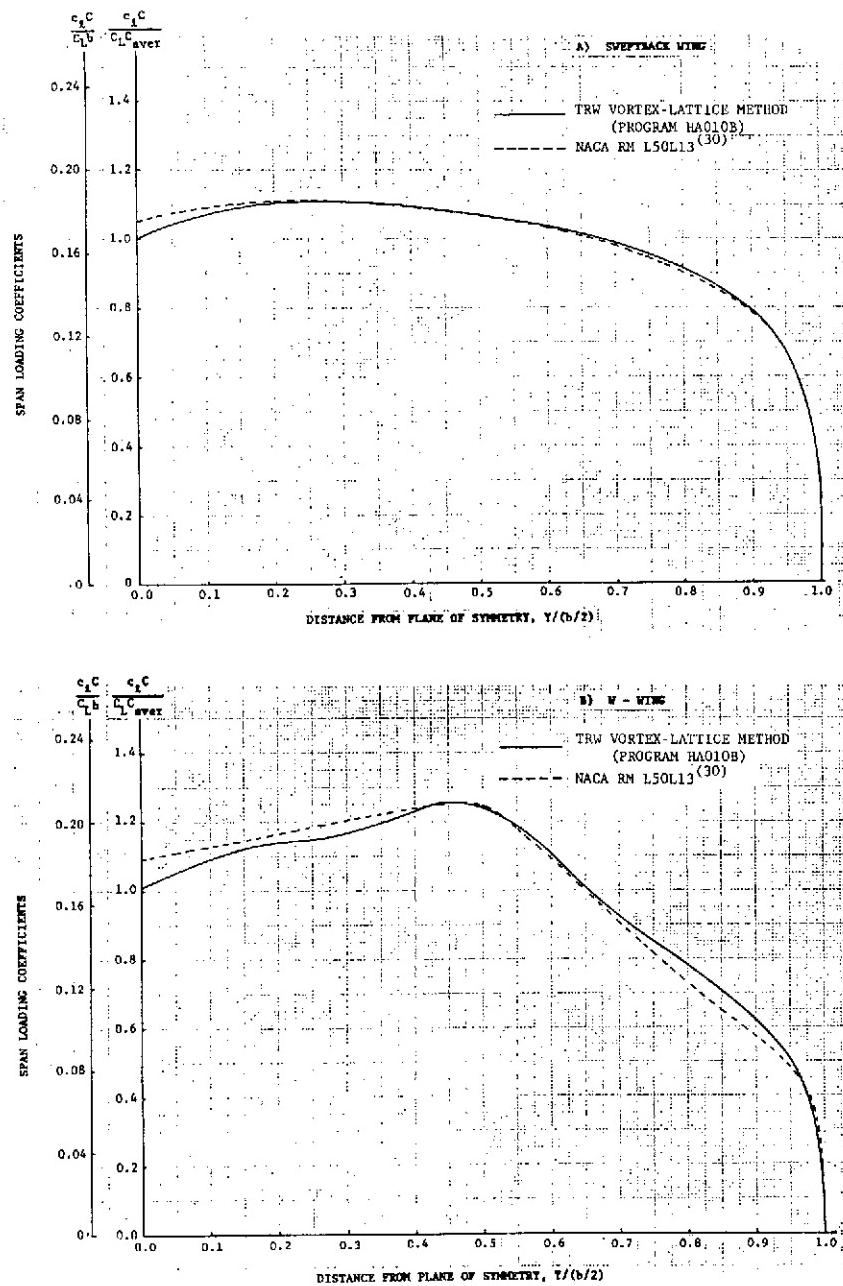


FIGURE 2.15 - LIFT DISTRIBUTION PREDICTION COMPARISONS FOR UNUSUAL WING PLANFORM CONFIGURATIONS

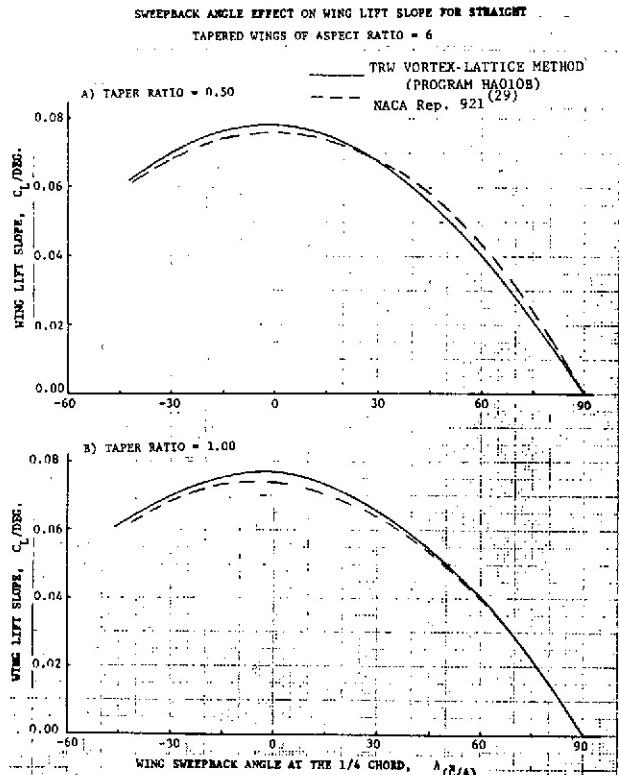


FIGURE 2.16 - SWEETBACK ANGLE EFFECT ON THE MAGNITUDE OF THE WING-LIFT-SLOPE FOR TAPERED WING PLANFORMS OF ASPECT RATIO = 6

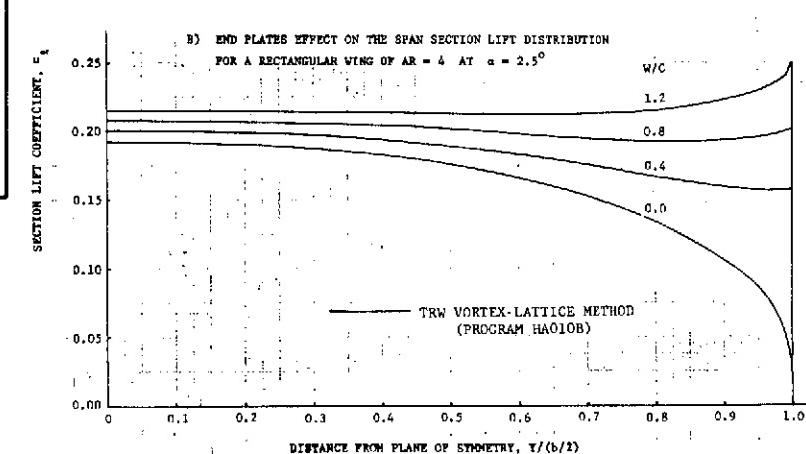
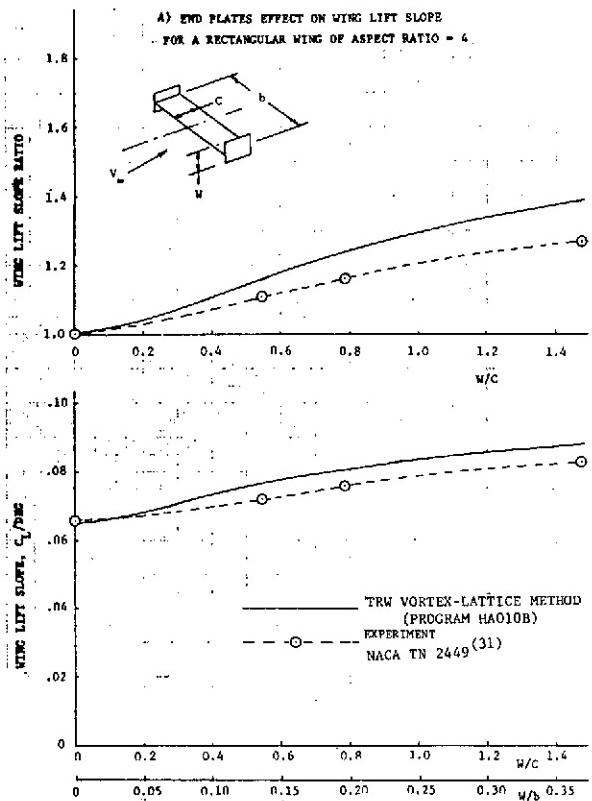
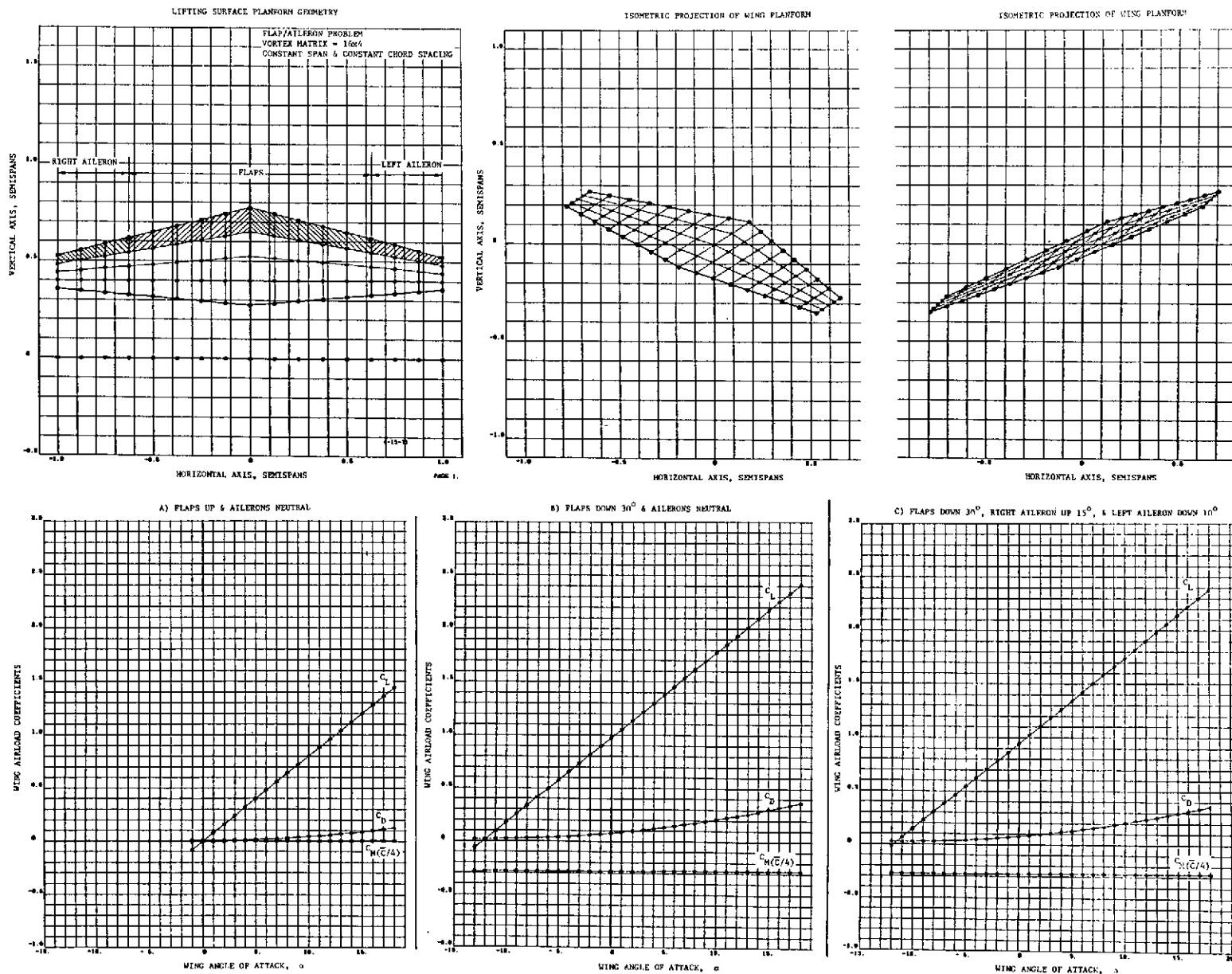


FIGURE 2.17 - WING LIFT PREDICTION COMPARISONS FOR A RECTANGULAR WING OF ASPECT RATIO = 6 WITH END PLATES



**FIGURE 2.18 - AIRLOAD PREDICTIONS (PROGRAM HA010B) FOR A SELECTED STRAIGHT-TAPERED WING PLANFORM WITH GEOMETRIC TWIST DUE TO CONTROL SURFACE DEFLECTIONS**

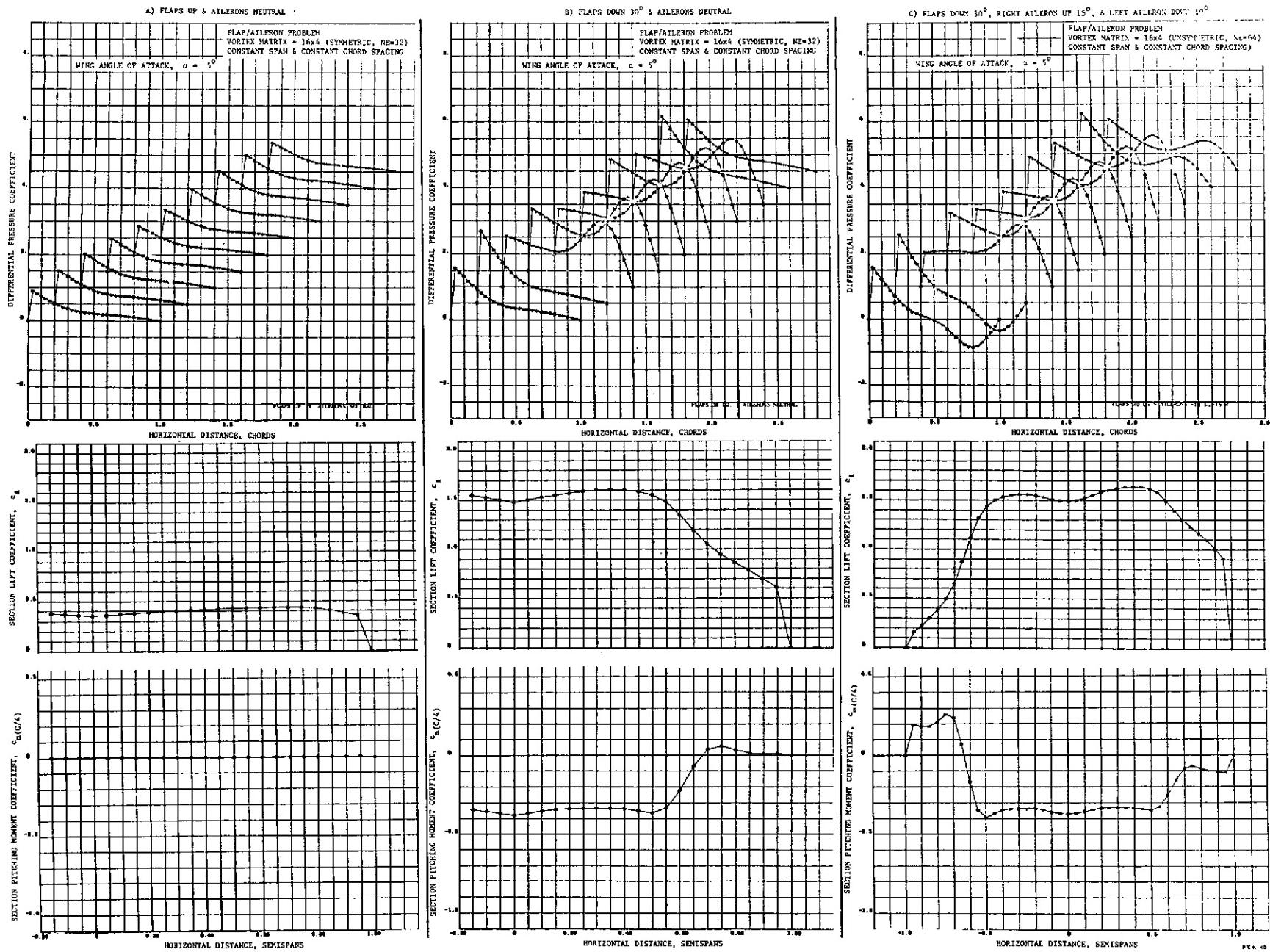


FIGURE 2.18 - AIRLOAD PREDICTIONS (PROGRAM HA01OB) FOR A SELECTED STRAIGHT-TAPERED WING PLANFORM WITH GEOMETRIC TWIST DUE TO CONTROL SURFACE DEFLECTIONS, CONTINUED.

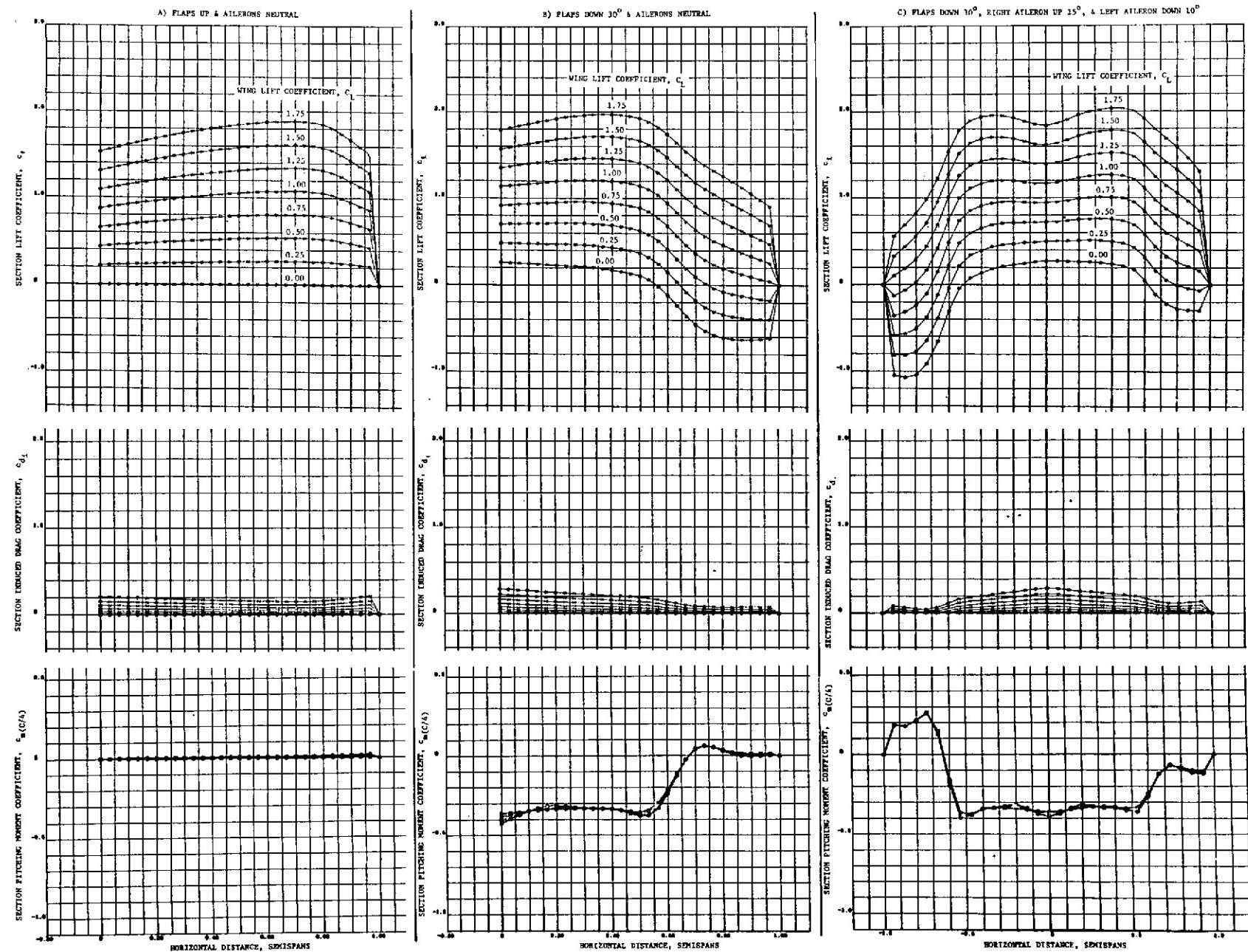


FIGURE 2.18 - AIRLOAD PREDICTIONS (PROGRAM HA010B) FOR A SELECTED STRAIGHT-TAPERED WING PLANFORM  
WITH GEOMETRIC TWIST DUE TO CONTROL SURFACE DEFLECTIONS, CONTINUED.

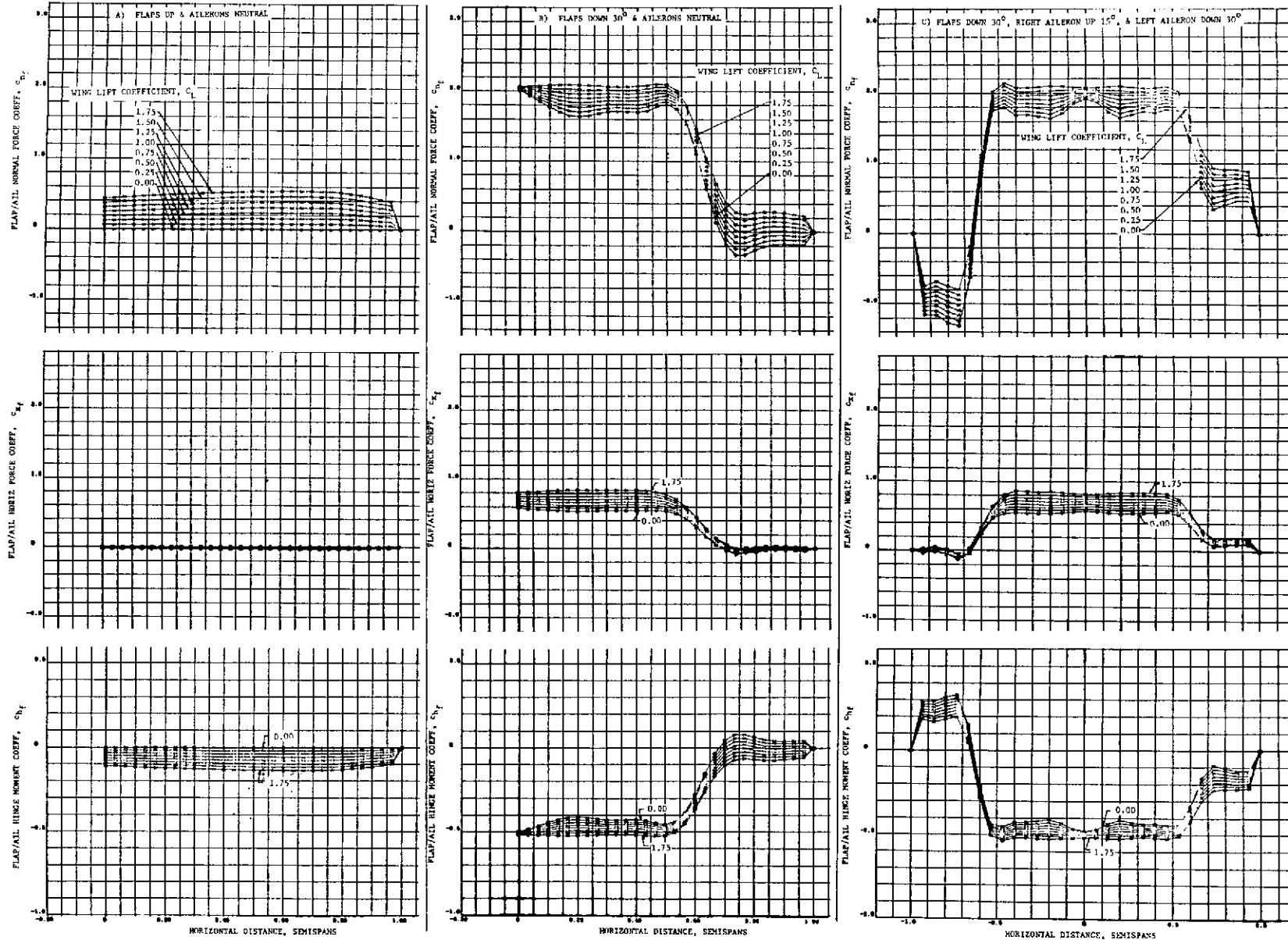


FIGURE 2.18 - AIRLOAD PREDICTIONS (PROGRAM HA010B) FOR A SELECTED STRAIGHT-TAPERED WING PLANFORM WITH GEOMETRIC TWIST DUE TO CONTROL SURFACE DEFLECTIONS, CONTINUED.

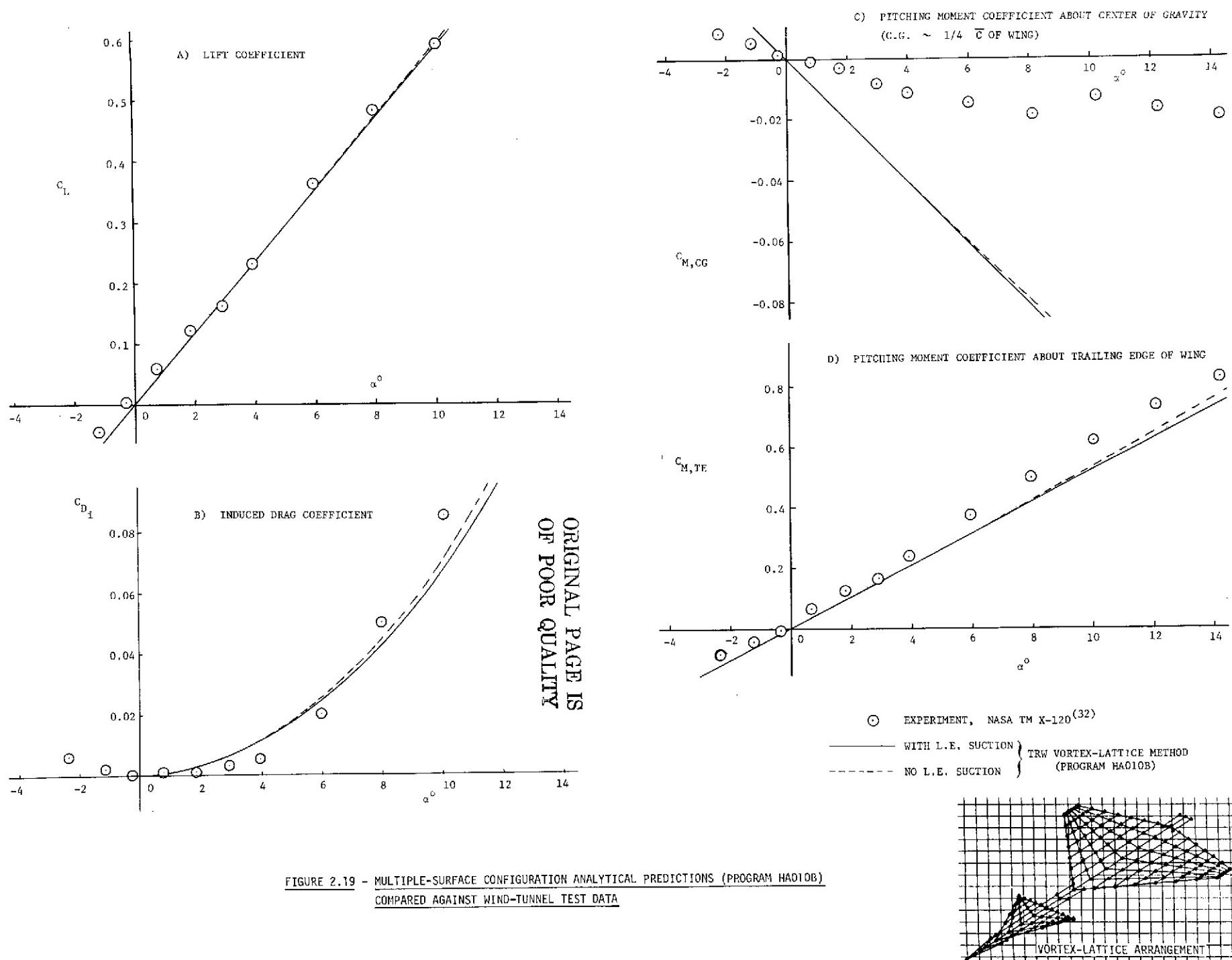


FIGURE 2.19 - MULTIPLE-SURFACE CONFIGURATION ANALYTICAL PREDICTIONS (PROGRAM HAD10B)  
COMPARED AGAINST WIND-TUNNEL TEST DATA

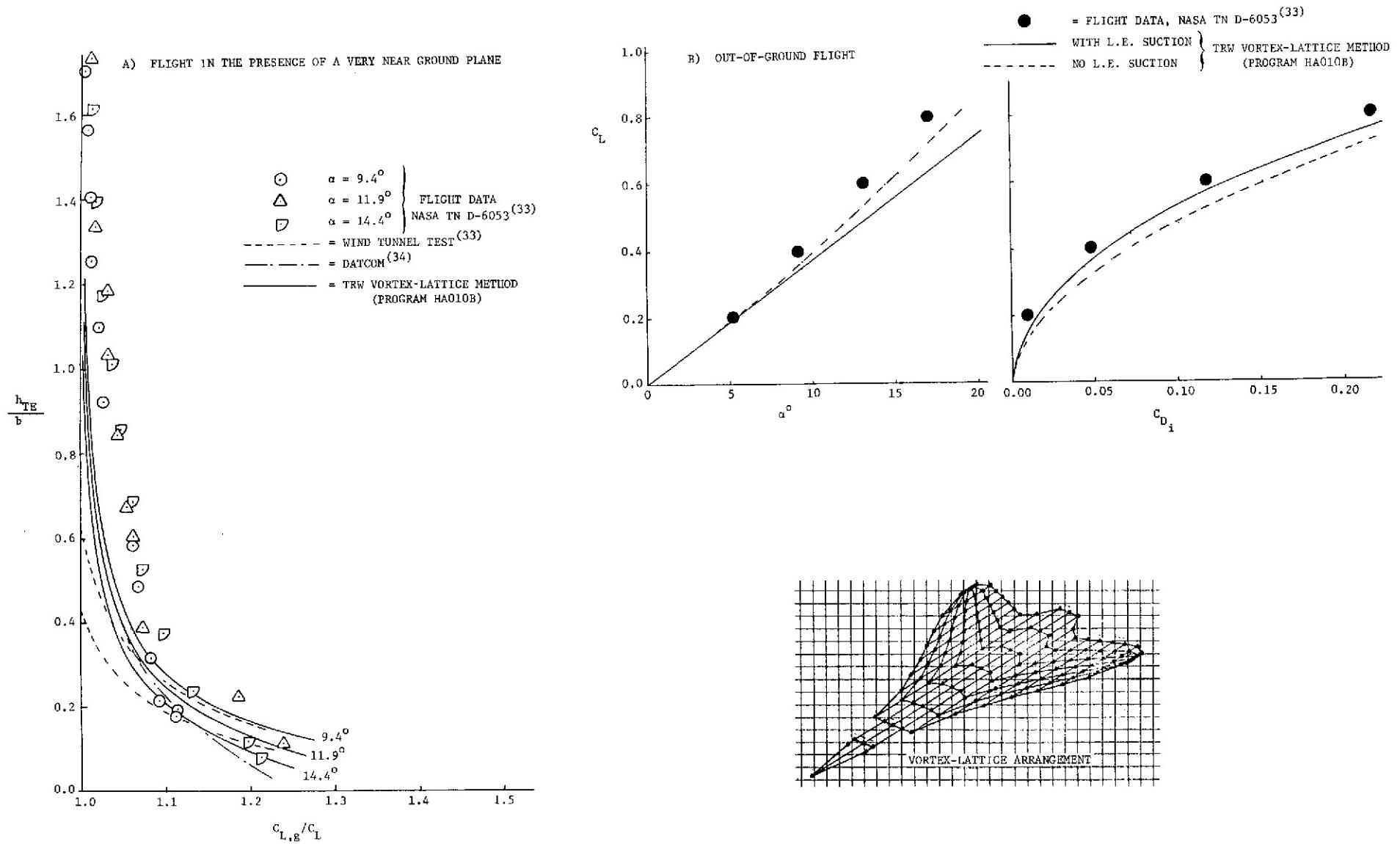


FIGURE 2.20 - MULTIPLE-SURFACE ANALYTICAL PREDICTIONS (PROGRAM HA010B) FOR THE DOUGLAS F5D-1 MODIFIED AIRPLANE WITH AN Ogee WING AND COMPARISONS AGAINST FLIGHT TEST DATA

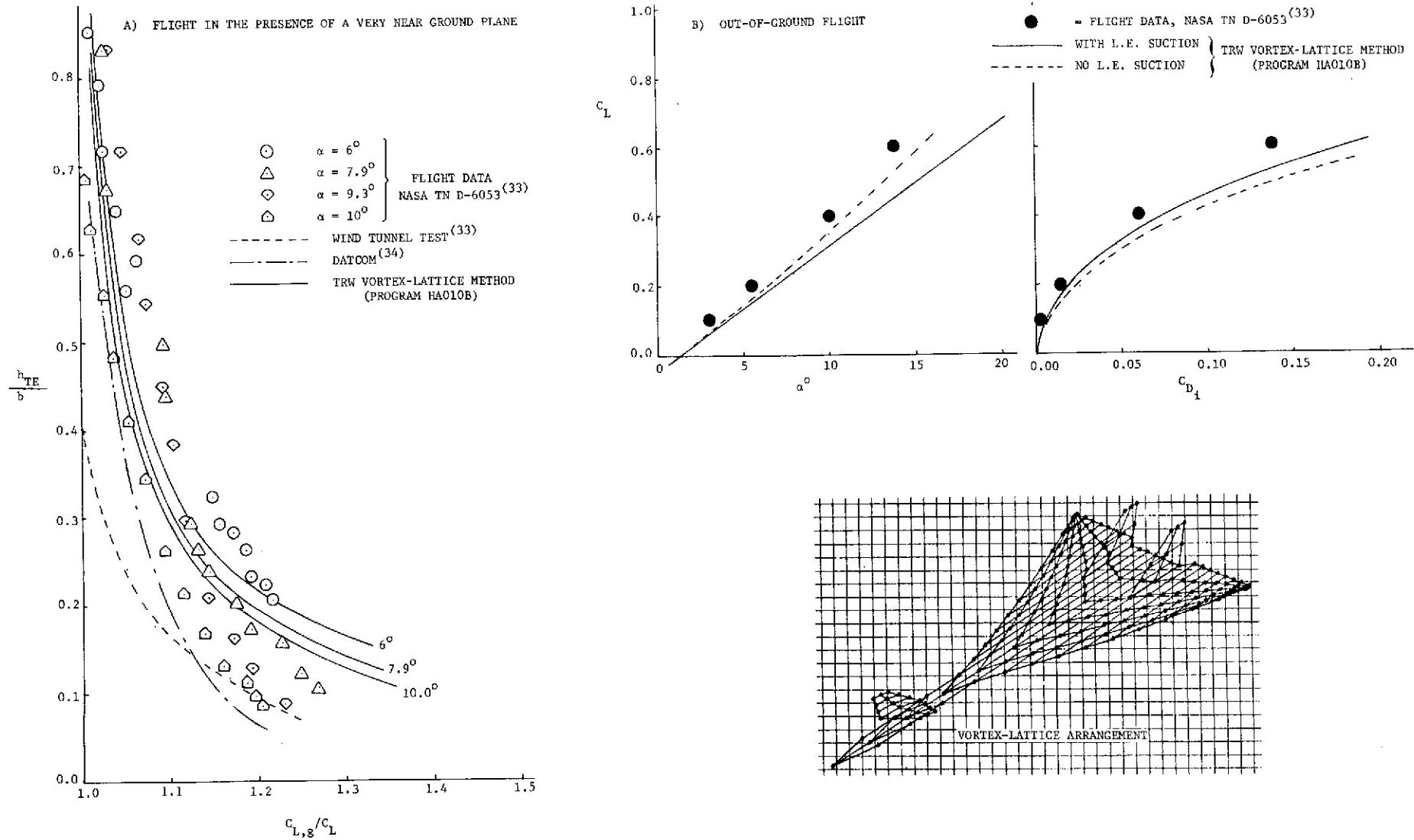


FIGURE 2.21 - MULTIPLE-SURFACE ANALYTICAL PREDICTIONS (PROGRAM HA010B) FOR THE NORTH AMERICAN XB-70 AIRPLANE AND COMPARISONS AGAINST FLIGHT TEST DATA

### 3.0 INPUT

#### 3.1 General Directions for Program Input

Five separate modes of execution are permitted for the TRW Vortex-Lattice Analysis Program #HA010B (N.SURFACE). These include:

- (1) two main execution modes for solving lifting-surface problems by the vortex-lattice method, i.e., SQT ISURF and NSURF execution,
- (2) two test execution modes for determining the accuracy of the matrix inversion procedure, i.e., XQT ISURFT and NSURFT execution, and (3) one auxiliary execution mode used for obtaining Calcomp or 4060-microfilm output, i.e., XQT TRWP LT execution.

##### 1) Main Execution Modes

Two main execution modes are permitted: XQT ISURF and SQT NSURF. These modes are used to analyze single- or multiple- lifting surface configurations respectively. Punched cards are used as the input media. NAMELIST statements and formatted statements are used exclusively. The input data is classified into groups, i.e., Group #1, Group #2, Group #3, and Group #4. A brief description of the information contained in each group and the arrangement order for input is given below:

<u>Group No.</u>	<u>Function</u>	<u>Contents</u>	<u>Type of Input</u>
#1 (START)	Execution Mode Card Mode = ISURF or NSURF	7/8 punch, space, XQT, space, mode	"A" format
#2	Job Identification (title) and Comments	1. Job Title (1 card) 2. Comments (3 cards)	"A" format
#3	Job execution controls and solution specifications	Namelist \$INPUT	NAMELIST
#4 (END)	Job/Jobs Termination	\$ENDJ0BS	"A" format

##### 2) Test Execution Modes

Two test execution modes are permitted: XQT ISURFT and SQT NSURFT. These two modes are used to determine the accuracy of the matrix inversion procedure for the ISURF and NSURF execution modes respectively. Only the execution mode card is required for input for the test execution modes, as follows:

### 3.1 General Directions for Program Input (Continued)

<u>Group No.</u>	<u>Function</u>	<u>Contents</u>	<u>Type of Input</u>
#1 (ONLY)	Execution Mode Card Mode = ISURFT or NSURFT	7/8 punch, space XQT, space, mode	"A" format

#### 3) Auxiliary Execution Mode

One auxiliary execution mode is permitted: XQT TRWPLT. This execution mode is contained in the second file of the program PCF tape and is used to generate Calcomp or 4060-microfilm output. The required input consists of the TRWPLT input instructions and a data tape. The description of the preparation of the input instructions is presented in Reference 35. The format and contents of the data tape which is generated in the execution of the main execution modes of the program is described under "Tape Output" in Section 5.3.

In preparing the program input (the main execution modes) the following conventions must be observed:

1. The first input card per case should be placed immediately following the XQT MODE card for the first case or behind the last card of the previous case for multiple case input. Blank cards between cases or input data groups should not be included in the input data deck.
2. For each case the arrangement of the input data must be ordered by groups, i.e., Group #1, Group #2, Group #3 and Group #4.
3. The last card of the input data deck is the end of jobs card (Group #4). This card must have \$ENDJ0BS on it only (Columns 2-9).
4. For namelist input, the first card must have the namelist on it only (i.e., \$INPUT in columns 2-7).
5. For namelist input, data cards must be punched between columns 2-80. Continuation cards may be freely used by starting on the next line where the previous line left off. Every card must terminate with a comma (,). Variables that are input via NAMELIST must be dimensioned, for example:

NSS(1) = 8,  
X(1) = 10, 15, 15, 20, 20, 20, 30,....

### 3.1 General Directions for Program Input (Continued)

There is no fixed order in which the variables are to be entered. They may be grouped at the user's discretion.

The following abbreviations may be used for repeating fields in a table:

X(1) = 10, 2\*15, 3\*20, 30, ..... is equivalent to

X(1) = 10, 15, 15, 20, 20, 20, 30, ..... or

X(1) = 10, X(4) = 3\*20, X(2) = 2\*15, ... etc.

6. For namelist input, the last card must have \$END on it only (Columns 2-5).
7. Differentiation between similar looking characters: To avoid confusion due to the similarity in appearance of certain characters, the following rules should be followed:
  - a. The alphabetic I is used as opposed to the numeric 1 (one).
  - b. The alphabetic Z is written Z as opposed to the numeric 2 (two).
  - c. The alphabetic O is written Ø as opposed to the numeric 0 (zero).

The detailed input instructions and definitions of all input quantities for the program are presented in this section in the following sequence: 1) program input setup guide (Pages 3-8, 3-9), 2) program input instructions (Pages 3-10 through 3-17), AND 3) an alphabetical list of all input quantities (Pages 3-18 through 3-20). In addition, the following information that is related to the preparation of the program input is found in the following sections or figures of this report:

- 1) Vehicle Geometry Sign Convention:  
see Figure 3.01, Page 3-4.
- 2) Vortex-Lattice Arrangement Restrictions:  
see Section 3.2.
- 3) Input Card-Deck-Setup Examples:  
see example problems, Section 6.1.
- 4) Control Deck Setup:  
see Figure 7.02.
- 5) Execution Time:  
see Section 7.2

3.1 General Directions for Program Input (Continued)

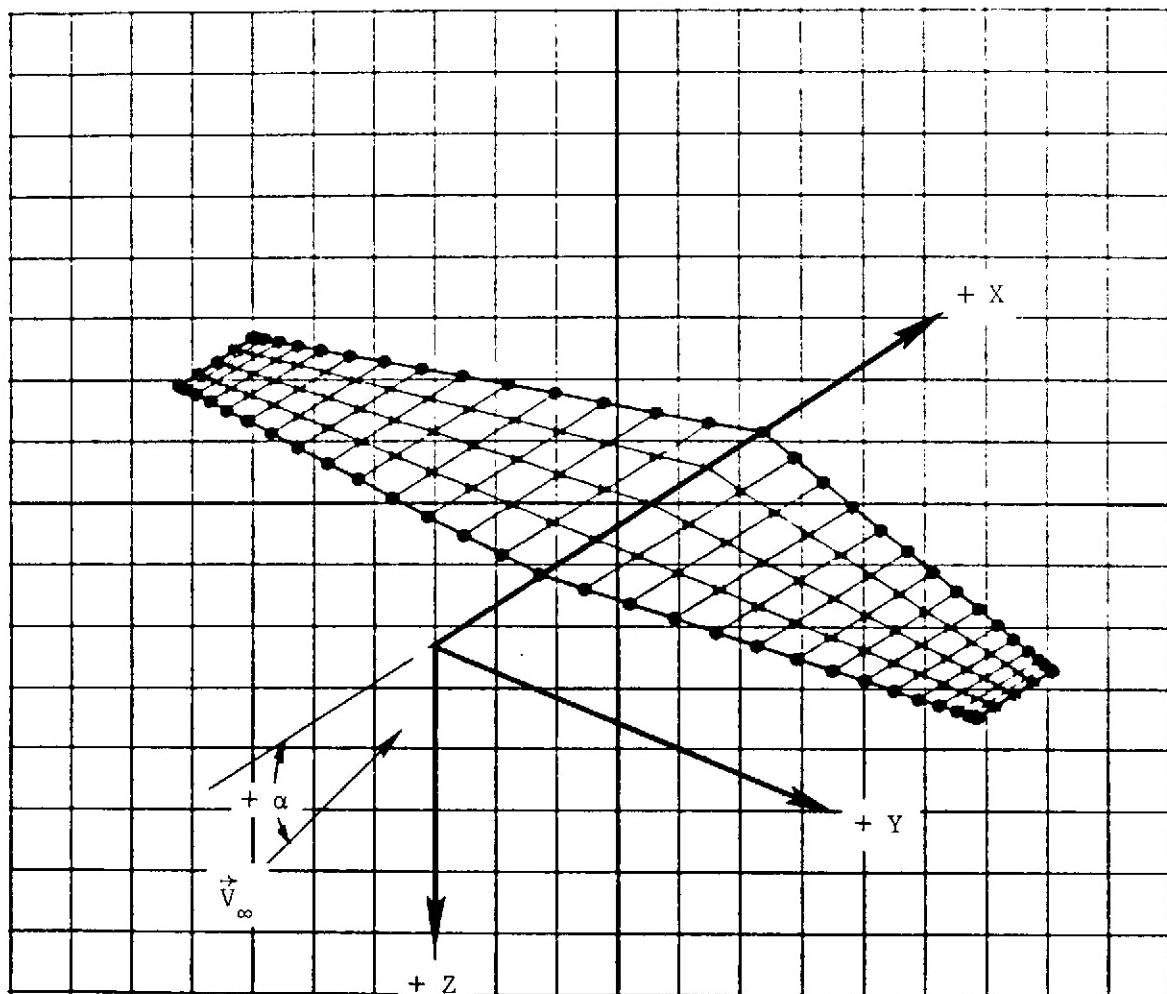


FIGURE 3.01 - LIFTING-SURFACES INPUT GEOMETRY SIGN CONVENTION  
(RIGHT HANDED COORDINATE SYSTEM)

### 3.2 Vortex-Lattice Arrangement Restrictions

The configuration of the vortex-lattice or arrangement of elemental panels that is specified in the input determines the validity of the solutions. In general, bad solutions are obtained when the number of elemental panels that determines the vortex-lattice arrangement is insufficient to properly represent the problem geometry. Other sources that lead to bad solutions are: the presence of sharp discontinuities in the lifting-surfaces geometry, unequal panel dimensions for adjacent elemental panels, and improper spacing of trailing vortices shed from forward surfaces that impinge on rear surfaces. The indicators that warn of the presence of bad solutions are:

1. The drag calculated for the sum of the total number of surfaces considered in a solution is negative. Although, negative drag is not always a good indicator for bad solutions because its magnitude is generally much smaller than the lift and therefore subject to more severe numerical roundoff errors, positive drag is unquestionably always an indicator of a good solution.
2. The calculated lift versus angle of attack curve is not smooth. The source of the errors that led to a bad solution can be determined by examining the magnitude of the calculated circulation for the vortex filaments or the spanwise lift distribution (see Figures 5.3 and 5.8).
3. The calculated values for lift and drag are out of range, i.e., the solution blew.

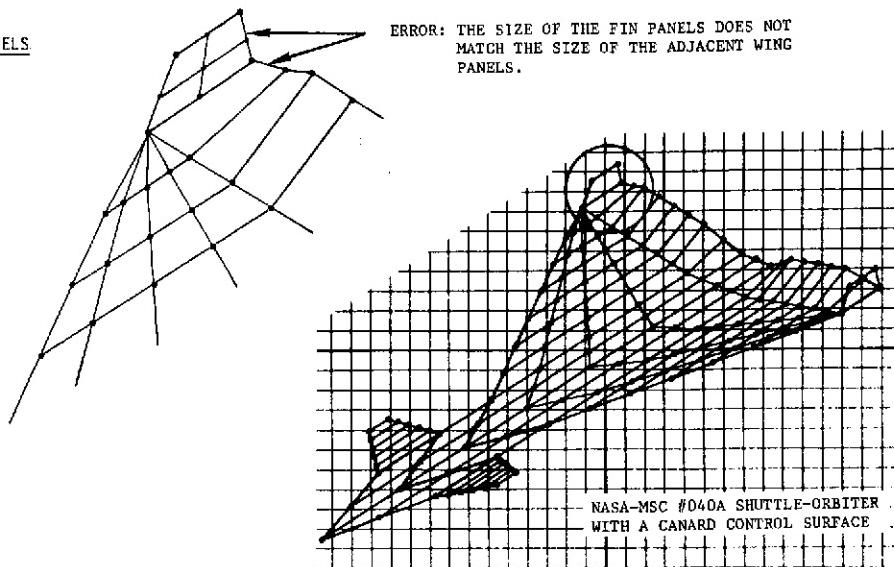
In the opposite side, a solution or a set of solutions may be considered to be good if by increasing the number of elemental panels or rearranging the configuration of the vortex-lattice by a small amount leads to a negligible variation of the magnitude of the calculated airload coefficients. It should be noted that: "there is no shortcut or formula presently available that, if followed, will always guarantee the generation of good solutions." The program user should be aware of this fact and should follow good judgement based on experience in aerodynamics in assessing the validity of the vortex-lattice solutions that he generates.

### 3.2 Vortex-Lattice Arrangement Restrictions (Continued)

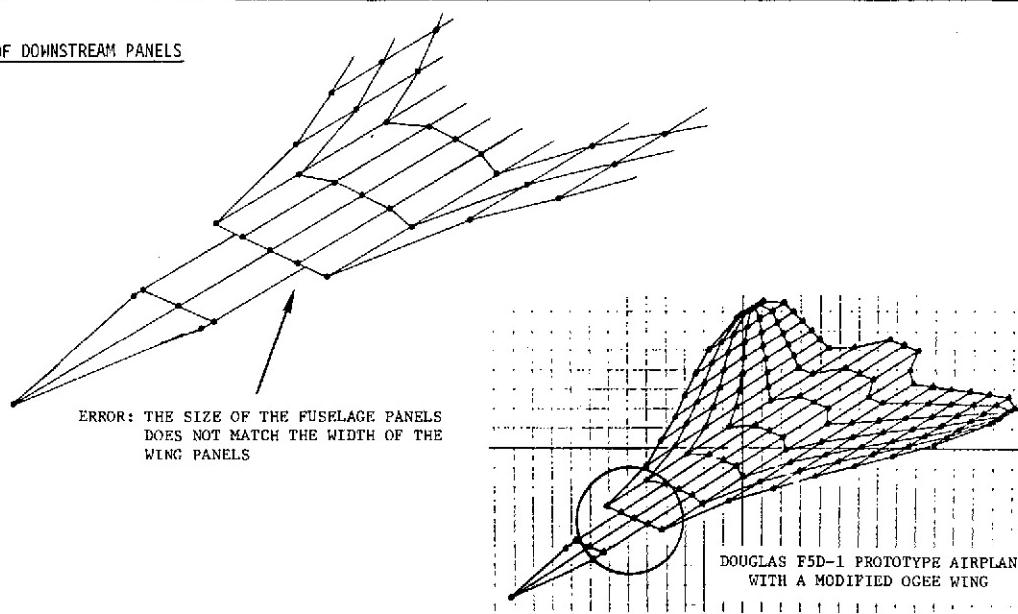
As a guide to engineers using the vortex-lattice analysis method for the first time, the user should adhere to the following general directions:

1. The larger the number of elemental panels used for representing a given lifting-surface configuration, the more accurate will be the solutions that will be obtained.
2. Adjacent panels should be of approximately equal size and should have approximately the same configuration, i.e., the variation in size and configuration between adjacent panels should be as small as possible (Figure 3.02[A]).
3. The width of panels in a column of one or more lifting surfaces should be exactly the same and must line up perfectly (Figure 3.02[B]). This requirement arises because of the approximate representation of the vorticity distribution on the lifting surfaces by discrete-size vortex filaments that are used in the vortex-lattice method. Note that the trailing vortices must lie equidistant to the co-location points in a row of elemental panels downstream. As a special feature of the program (TRW Vortex-Lattice Analysis Program #HA010B), the trailing vortices can be located exactly in line with a column of co-location points (Figure 3.02[C]). In this instance, the velocity induced by these vortices at the co-location points (which may be indefinite) is simply ignored.

A) SIZE OF ADJACENT PANELS



B) WIDTH OF DOWNSTREAM PANELS



C) SPACING OF UPSTREAM VORTICES

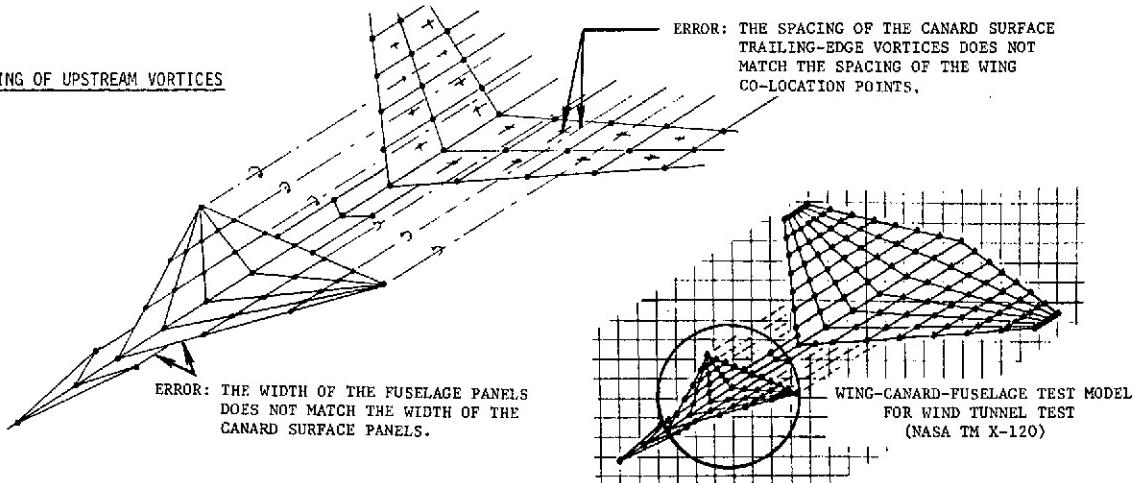


FIGURE 3.02 - ILLUSTRATION OF POOR VORTEX-LATTICE ARRANGEMENT  
Oversized inserts are shown in error

### 3.3 PROGRAM INPUT SETUP GUIDE

```

▽ Z RUN 54589,TRW,0001,3303A,0001,P,3,1
▽ N MSG     FILE REQ. TAPE 1 FH432 3 FSTRN 1
▽ ASG X=A10202
▽ ASG F
▽ PLT
▽ XQT CUR
  TRW X
  ERS
  IN X
  PEF X
  TRI X
  TQC
▽ XQT MODE   (MODE= NSURF OR ISURF)
JOB TITLE FOR JOB 1 (1 CARD)
COMMENTS, REQUIRED FOR JOB 1 (3 CARDS)
$INPUT
NFLG,IFLG,
KOUT,KT1,KT2,KT3,LINX,
NWING,NFUS,NVTAIL,
NSS,X,Y,Z,E,C,XQCR,YSAN,
NCS,XQC,ZQC,
WFLAP1,WFLAP2,WFLAP3,FLAPC,TABC,FLAPUJ,TABDJ,AILDJ,
XCG,YCG,ZCG,REFS,REFC,REFB,GSCALE,
NJOB,ALFA,MACHN,HEIGHT,FLAPDJ,AILDJ,NSOLV,
NJBL,WCL,
CBLCP,WSMOTH,LFLAP,LDRAG,CLEANF,PMECF,CUTOF1,CUTOF2
$END
JOB TITLE FOR JOB 2 (1 CARD)
$INPUT
NAMELIST DATA
$END
$ENDJOB5
▽ XQT TRWPLT
  KUNIT = 0
  ICCOMP = 0
  NTRAN = 0
  IPRINT = 0
  NTYPE = 0
  NDFSCL = 1
  ISCALY = 1,1,1,1,1,1,1,1,1,1
  NXL = 24
  NXR = 24
  NYL = 24
  NYH = 24
  NP0SN1 = 600, 950
  NP0SN2 = 600, 925
  NP0SN3 = 600, 900
  NP0SN4 = 600, 90
  CHARSZ = 1,0,1,0,1,0,1,0

```

▽ = 7/8 PUNCH.

NOTE: THE FOLLOWING CONTROL CARDS ARE OPTIONAL FOR INPUT

▽ N MSG = MESSAGE CARD (REQUIRED FOR NASA-MSC)

▽ PLT = REQUIRED FOR PLOT OUTPUT

INPUT INSTRUCTIONS FOR THE CALCOMP/4060-MICROFILM PLOT-OUTPUT OPTION,  
XQT TRWPLT, ARE FOUND IN REFERENCE 35. THESE INSTRUCTIONS HAVE BEEN  
OMITTED IN THE PRESENT REPORT.

JOB CARD  
MESSAGE CARD  
PROGRAM PCF TAPE NO.  
REQUIRED IF TRW PLOT  
OPTION IS USED  
READ-IN PROGRAM CARDS  
(LOAD THE PROGRAM)

|  
 (IF PLOT OPTION USED)

EXECUTION MODE CARD  
JOB TITLE-START JOB 1  
COMMENTS  
START NAMELIST \$INPUT  
JOB-EXECUTION FLAGS  
OUTPUT SPECIFICATIONS  
LIFTING SURFACE TYPE  
LIFTING SURFACES PLAN  
AIRFOIL SECTION  
FLAP-TAB-AILERONS  
REFERENCE DIMENSIONS  
FLIGHT ATTITUDE SPECS  
LINEARIZED THEORY  
OPTIONAL INPUT CONST.  
END NAMELIST \$INPUT  
JOB TITLE-START JOB 2  
START NAMELIST \$INPUT  
DATA FOR JOB 2  
END NAMELIST \$INPUT  
END OF ALL JOBS

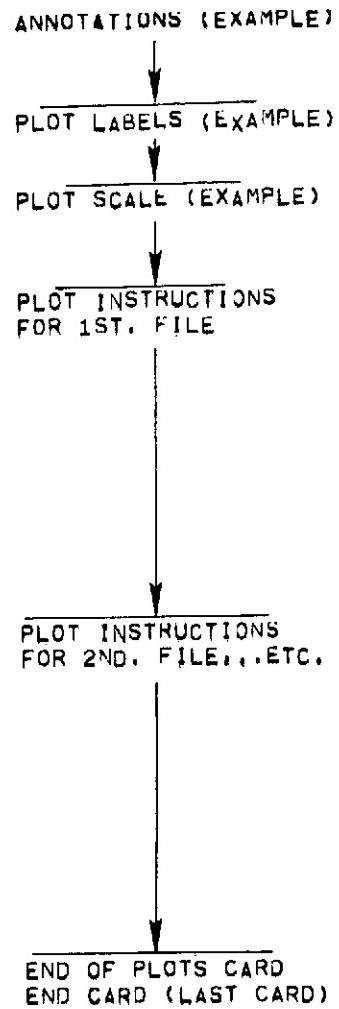
EXECUTE PLOT OPTION  
PLOT EXEC. CONSTANTS

### 3.3 PROGRAM INPUT SETUP GUIDE (CONTINUED)

```

ANNØT1 = ID = EXAMPLE PRØB. 1 - MULTIPLE-SURFACE
ANNØT2 = ID = CAPABILITY DEMONSTRATION RUN
ANNØT3 = ID = A.GØMEZ/ 5 JULY 72
ANNØT4 = ID =
TITLE = ID = ISØMETRIC PROJECTION ØF LIFTING SURFACES
XLABEL = ID = HORIZONTAL AXIS, SEMISPANS
YLABEL = ID = VERTICAL AXIS SEMISPANS
XHI= 1.5
XLØ=-1.0
YHI= 1.5
YLØ=-1.5
PLØT = 2,1, 3,1, ENDLST
ENDPLT
ANNØTSV = 0
NØADV = 1
PLØT = 5,1, 6,1, ENDLST
ENDPLT
NØADV = 1
PLØT = 2,2, 3,2, ENDLST
ENDPLT
NØADV = 1
PLØT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
NØADV = 1
PLØT = 2,1, 3,1, ENDLST
ENDPLT
NØADV = 1
PLØT = 5,1, 6,1, ENDLST
ENDPLT
NØADV = 1
PLØT = 2,2, 3,2, ENDLST
ENDPLT
NØADV = 1
PLØT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
ENDRUN
*EOF

```



ORIGINAL PAGE IS  
OF POOR QUALITY

### 3.4 INPUT INSTRUCTIONS

#### GROUP 1 - EXECUTION MODE CARD.

\* FIVE SEPARATE EXECUTION MODES ARE PERMITTED \*

- (1)  $\nabla$  XQT NSURF (COLUMNS 1-11) 1 TO 5 LIFTING SURFACES MAY BE CONSIDERED SIMULTANEOUSLY.
- (2)  $\nabla$  XQT ISURF (COLUMNS 1-11) ONLY 1 LIFTING SURFACE MAY BE CONSIDERED WITH OR WITHOUT LINEARIZED LIFT OPTION.
- (3)  $\nabla$  XQT NSURFT (COLUMNS 1-12) MATRIX INVERSION TEST FOR XQT NSURF MODE.
- (4)  $\nabla$  XQT ISURFT (COLUMNS 1-12) MATRIX INVERSION TEST FOR XQT ISURF MODE.
- (5)  $\nabla$  XQT TRWPLT (COLUMNS 1-12) PLOT OPTION(REFERENCE 35)

#### GROUP 2 - JOB IDENTIFICATION (TITLE) AND COMMENTS,

\* REQUIRED INPUT FOR NSURF AND ISURF EXECUTION MODES \*

CARD 1            FORMAT(13A6,A2)    (TITLE(I),I=1,14)

CARDS 2,3,4      FORMAT((13A6,A2)) (COMTS(I),I=1,42) (JOB 1 ONLY)

#### GROUP 3 - VORTEX-LATTICE ANALYTICAL SOLUTION SPECIFICATIONS,

\* REQUIRED INPUT FOR NSURF AND ISURF EXECUTION MODES \*

\*\* NAMELIST INPUT FORMAT \*\*

```
NAMELIST/INPUT/ NFLG ,IFLG ,KOUT ,KT1 ,KT2 ,KT3 ,LINX  
*,NWING ,NFUS ,NVTAIL,NSS ,X ,Y ,Z ,E ,C  
*,X0CR ,YSPAN ,NCS ,X0C ,Z0C ,WFLAP1,WFLAP2,WFLAP3,FLAPC  
*,TABC ,FLAPDJ,TABDJ ,AILDJ ,XCG ,YCG ,ZCG ,REFS ,REFC  
*,REFB ,GSCALE,NJ0B ,ALFA ,MACHN ,HEIGHT,FLAPDJ,AILDJ ,NSDLV  
*,NJ0BL ,WCL ,CBL0CP,WSM0TH,LFLAP ,LDRAG ,CLEANF,PMECF ,CUTOF1  
*,CUTOF2
```

\*\* JOB-EXECUTION FLAGS \*\*

(1) NFLG REQUIRED FOR NSURF EXECUTION MODE.

(NFLG(N),N=1,M)     NUMBER OF SPANWISE VORTEX-LATTICE ELEMENTS ASSIGNED  
                      TO THE N SURFACE, WHERE M.LE.5.

### 3.4 INPUT INSTRUCTIONS (CONTINUED)

(NFLG(N+5),N=1,M) NUMBER OF CHORDWISE VORTEX-LATTICE ELEMENTS ASSIGNED TO THE N SURFACE.

(NFLG(N+10),N=1,M) NUMBER OF CHORDWISE DISCONTINUITIES ASSIGNED TO THE N SURFACE, WHERE,

NFLG(N+10),EQ.0 NO FLAPS AND/OR AILERONS,  
NFLG(N+10),GE.1 WITH FLAPS AND/OR AILERONS,  
NFLG(N+10),EQ.2 WITH TAB SURFACE.

NFLG(16) = 0 ZOC(K,J) INPUT IS DIMENSIONLESS (NORMALIZED BY C(J)).  
= 1 ZOC(K,J) INPUT IS DIMENSIONED USING THE SAME UNITS AS THE WING PLANFORM SPECIFICATIONS (E,G., Y(J),X(J),ETC.)

NFLG(17) = 0 NO EFFECT (OUT-OF-GROUND).  
= 1 GROUND EFFECTS, I.E., FLIGHT IN THE PRESENCE OF A GROUND PLANE ARE CALCULATED.

NFLG(18) = 0 NO EFFECT.  
= 1 ARRAYS OF SOLUTIONS USING LIFTING LINE THEORY ARE CALCULATED FROM A PAIR OF EXACT VORTEX-LATTICE SOLUTIONS, THIS OPTION NOT OPERATIONAL AT PRESENT,

NFLG(19) = 0 NO EFFECT.  
= 1 CALCOMP OR MICROFILM PLOT DATA TAPE IS GENERATED.

NFLG(20) = ND PRINT-OUTPUT CONTROL EFFICIENCY FLAG ASSIGNMENT, USED AS FOLLOWS,

ND,GE,0 = SHORT-PRINT OUTPUT, I.E., NAMELIST \$INPUT, SURFACES GEOMETRY, AIRFOIL MEAN-CAMBER, AND, SECTION AND SPATIALLY-INTEGRATED AIRLOAD COEFFICIENTS ARE OUTPUT,

ND,GE,1 = VORTEX-LATTICE GEOMETRY DETAIL IS OUTPUT.

ND,GE,2 = VORTEX-LATTICE ELEMENTAL LIFT AND INDUCED VELOCITY ARE OUTPUT

ND,GE,5 = VORTEX-LATTICE GEOMETRY DETAIL, AND INDUCED VELOCITY INCREMENTS ARE OUTPUT.

ND,GE,8 = DEBUG OUTPUT FOR PROGRAM CHECK/DEVELOPMENT, I.E., NAMELISTS \$DEBUG1, \$DEBUG2, AND \$DEBUG3 ARE OUTPUT.

ND,GT,15,AND,NFLG(17),GE,1 = DEBUG OUTPUT FOR PROGRAM CHECK/DEVELOPMENT, I.E., NAMELIST \$REFLEX IS OUTPUT.

#### (2) IFLAG REQUIRED FOR ISURF EXECUTION MODE.

-----

IFLG(1) = 0 SYMMETRIC LIFT LOADING, NOT REQUIRED FOR INPUT, VALUES  
= 1 UNSYMMETRIC LIFT LOADING, ARE ASSIGNED IN EXECUTION

IFLG(2) = NSD NUMBER OF SPAN DISCONTINUITIES, NSD= 0,1,2,3,OR 4,  
REQUIRED INPUT IF IFLG(4),NE.0.

IFLG(3) = NSE NUMBER OF SPAN VORTEX-LATTICE ELEMENTS, NSE,LE,NSEMAX,  
WHERE NSEMAX=41 AND 21 FOR SYMMETRIC AND UNSYMMETRIC  
LIFT LOADING RESPECTIVELY.

IFLG(4) = 0 EQUAL SPAN-SPACING FOR VORTEX-LATTICE ELEMENTS.  
= 1 COSINE (VARIABLE) SPAN SPACING OF VORTEX-LATTICE ELEMENTS,  
= 2 SPAN-SPACING OF VORTEX-LATTICE ELEMENTS IS TO BE ASSIGNED IN THE INPUT, (YSPAN(N),N=1,NSE),

### 3.4 INPUT INSTRUCTIONS (CONTINUED)

IFLG(5) = NCD            NUMBER OF CHORD DISCONTINUITIES, WHERE NCD=0 AND NCD=1  
                          MUST BE ASSIGNED TO UNFLAPPED AND FLAPPED WING SURFACES  
                          RESPECTIVELY.

IFLG(6) = NCE            NUMBER OF CHORD VORTEX-LATTICE ELEMENTS, NCE.LE,NCEMAX,  
                          WHERE NCEMAX=9, AND NCE,GE,2 FOR FLAPPED SURFACES.

IFLG(7) = 0            EQUAL CHORD-SPACING FOR VORTEX-LATTICE ELEMENTS,  
                          = 1 COSINE (VARIABLE) CHORD SPACING OF VORTEX-LATTICE  
                          ELEMENTS.

IFLG(8) = 0            NO EFFECT.  
                          = 1 ARRAYS OF SOLUTIONS USING LIFTING LINE THEORY ARE  
                          CALCULATED FROM A PAIR OF EXACT VORTEX-LATTICE  
                          SOLUTIONS.

IFLG(9) = 0            NO EFFECT.  
                          = 1 GROUND EFFECTS, I.E., FLIGHT IN THE PRESENCE OF A GROUND  
                          PLANE ARE CALCULATED.

IFLG(10) = ND           PRINT-OUTPUT CONTROL EFFICIENCY FLAG ASSIGNMENT,  
                          USED AS FOLLOWS,

                         ND.GE,0 = SHORT-PRINT OUTPUT, I.E., NAMELIST \$INPUT,  
                          SURFACES GEOMETRY, AIRFOIL MEAN-CAMBER, AND,  
                          SECTION AND SPATIALLY-INTEGRATED AIRLOAD  
                          COEFFICIENTS ARE OUTPUT.

                         ND.GE,1 = VORTEX-LATTICE GEOMETRY DETAIL IS OUTPUT.

                         ND.GE,2 = VORTEX-LATTICE ELEMENTAL LIFT AND INDUCED  
                          VELOCITY ARE OUTPUT

                         ND.GE,5 = VORTEX-LATTICE GEOMETRY DETAIL, AND INDUCED  
                          VELOCITY INCREMENTS ARE OUTPUT.

                         ND.GE,8 = DEBUG OUTPUT FOR PROGRAM CHECK/DEVELOPMENT,  
                          I.E., NAMELISTS \$DEBUG1, \$DEBUG2, AND \$DEBUG3  
                          ARE OUTPUT.

                         ND.GT,15,AND,IFLG(9),GE,1 = DEBUG OUTPUT FOR PROGRAM  
                          CHECK/DEVELOPMENT, I.E., NAMELIST \$REFLEX  
                          IS OUTPUT.

IFLG(11)= 0            NO EFFECT.  
                          = 1 OUTPUT SOLUTIONS FOR CHORDWISE AND SPANWISE SECTION  
                          AIRLOAD COEFFICIENTS.

IFLG(12)= 0            NO EFFECT,  
                          = 1 OUTPUT SURFACE PLANFORM GEOMETRY ON CALCOMP/MICROFILM  
                          PLOT TAPE.

IFLG(13)= 0            NO EFFECT,  
                          = 1 OUTPUT CHORD AND SPAN SECTION AIRLOAD COEFFICIENTS ON  
                          CALCOMP/MICROFILM PLOT TAPE.

IFLG(14)= 0            NO EFFECT,  
                          = 1 OUTPUT LINEARIZED SOLUTION OF AIRLOAD COEFFICIENTS ON  
                          CALCOMP/MICROFILM PLOT TAPE.

IFLG(15)               NOT A REQUIRED INPUT, VALUE ASSIGNED IN EXECUTION.

#### **\*\* OUTPUT SPECIFICATIONS \*\***

K0UT            (=6 IF OMITTED) PRINT BCD OUTPUT PHYSICAL UNIT ASSIGNMENT,  
KT1            (=1 IF OMITTED) SCRATCH/WORK PHYSICAL UNIT ASSIGNMENT.

### 3.4 INPUT INSTRUCTIONS (CONTINUED)

KT2 (=8, ASG LOGICAL UNIT F, IF OMITTED) CALCOMP/MICROFILM DRUM OR TAPE PHYSICAL UNIT ASSIGNMENT.

KT3 (=3 IF OMITTED) SCRATCH/WORK PHYSICAL UNIT ASSIGNMENT.

LINX (=56 IF OMITTED) MAXIMUM NUMBER OF LINES PER PAGE FOR PRINTED OUTPUT.

#### **\*\* SURFACE TYPE CLASSIFICATIONS \*\***

\* OMIT FOR XQT ISURF EXECUTION MODE \*

NWING (=1 IF OMITTED) NUMBER OF SYMMETRIC LIFTING SURFACES, E.G., WING SURFACES, THAT MUST BE ORDERED AS FOLLOWS,

N = 1,2,3,...,NWING, (N,LE,5)

NFUS (=0 IF OMITTED) NUMBER OF ANTISSYMMETRIC LIFTING SURFACES, E.G., VERTICAL SURFACE/S ASSIGNED TO REPRESENT A FUSELAGE OR A VERTICAL FIN, THAT MUST BE ORDERED AS FOLLOWS,

N = 1,2,3,...,NWING+NFUS, (N,LE,5)

NVTAIL (=0 IF OMITTED) NUMBER OF ANTISSYMMETRIC LIFTING SURFACES, E.G., VERTICAL SURFACE/S ASSIGNED TO REPRESENT A VERTICAL FIN, TWIN FINS, END PLATES, ETC., THAT MUST BE ORDERED AS FOLLOWS,

N = 1,2,3,...,NWING+NFUS+IABS(NVTAIL), (N,LE,5)

NVTAIL MAY BE ENTERED AS A POSITIVE OR A NEGATIVE INTEGER IN ORDER TO SPECIFY SYMMETRY ABOUT THE PLANE Y=0, I.E.,

+ INTEGER = ANTISSYMMETRIC SURFACE, E.G., A SINGLE FIN,  
- INTEGER = SYMMETRIC SURFACE, E.G., TWIN FINS,

NS (NOT AN INPUT QUANTITY) TOTAL NUMBER OF SURFACES TO BE CONSIDERED THAT IS CALCULATED INTERNALLY USING THE FOLLOWING FORMULA

NS= NWING + NFUS + IABS(NVTAIL) (NS,LE,5)

N (NOT AN INPUT QUANTITY) ORDER NUMBER ASSIGNED TO NTH SURFACE.

#### **\*\* SURFACE PLANFORM SPECIFICATIONS \*\***

\* NS= 1 FOR XQT ISURF EXECUTION MODE \*

(NSS(N),N=1,NS) STORAGE ORDER NUMBER ALLOCATED TO THE LAST SPAN STATION ENTRY FOR THE N LIFTING SURFACE, WHERE:

NSS(1) = NUMBER OF SPAN STATION ENTRIES ALLOCATED TO THE FIRST SURFACE,

NSS(N)-NSS(M) = NUMBER OF SPAN STATION ENTRIES ALLOCATED TO THE N SURFACE, IN ORDER, N=1,2,...,M,N,...,NS.

(X(J),J=1,NSS(NS)) LONGITUDINAL COORDINATE OF JTH, POINT OF THE REFERENCE LOFT LINE, E.G., FUSELAGE STATIONS,

(Y(J),J=1,NSS(NS)) SPANWISE COORDINATE OF JTH, POINT OF THE REFERENCE LOFT LINE, E.G., WING STATIONS,

(Z(J),J=1,NSS(NS)) VERTICAL COORDINATE OF JTH, POINT OF THE REFERENCE LOFT LINE, E.G., WATERLINE STATIONS,

(E(J),J=1,NSS(NS)) ANGLE OF TWIST OF CHORD PLANE RELATIVE TO THE LONGITUDINAL COORDINATE FOR THE AIRFOIL SECTION AT THE JTH,POINT OF THE REFERENCE LOFT LINE,

### 3.4 INPUT INSTRUCTIONS (CONTINUED)

(C(J),J=1,NSS(NS)) CHORD LENGTH DIMENSION OF THE AIRFOIL SECTION AT THE JTH,POINT OF THE REFERENCE LOFT LINE.

(X0CR(J),J=1,NSS(NS)) (OMIT FOR XQT ISURF) THE RELATIVE LOCATION OF THE REFERENCE LOFT LINE IN CHORDS MEASURED FROM THE LEADING EDGE FOR THE JTH,POINT.

(X0CR(N),N=1) (OMIT FOR XQT NSURF) THE RELATIVE LOCATION OF THE REFERENCE LOFT LINE IN CHORDS MEASURED FROM THE LEADING EDGE ASSUMED CONSTANT FOR THE NTH,SURFACE,

(YSPAN(N),N=1,NSE+1) (REQUIRED IF(IFLG,GE,2) ) SPAN STATIONS THAT BOUND THE VORTEX MATRIX ELEMENTS.

#### **\*\* AIRFOIL SECTION (CAMBER) SPECIFICATIONS \*\***

(NCS(N),N=1,NS) NUMBER OF CHORD STATIONS ALLOCATED FOR DESCRIBING THE AIRFOIL SECTION MEAN CAMBER LINE FOR THE NTH, LIFTING SURFACE, WHERE,  
NCS(N).GE.2, AND/OR NCS(N).LE.10.

((X0C(K,N),K=1,NCS(N)),N=1,NS) CHORD STATION OF AIRFOIL SECTION, I.E., DISTANCE FROM THE LEADING EDGE MEASURED IN CHORDS ALONG THE AIRFOIL SECTION CHORD PLANE.

((Z0C(K,J),K=1,NCS(N)),  
J=1,NSS(NS),AND,  
N=1,NS) AIRFOIL SECTION MEAN CAMBER SPECIFICATION, I.E., NORMAL DISTANCE TO THE MEAN CAMBER LINE MEASURED IN CHORDS FROM THE AIRFOIL SECTION CHORD PLANE, CORRESPONDING TO THE JTH, POINT OF THE REFERENCE LOFT LINE.

#### **\*\* CONTROL SURFACE GEOMETRY SPECIFICATIONS \*\***

(WFLAP1(N),N=1,NS) SPAN DISTANCE FROM PLANE OF SYMMETRY TO THE INNER BOUNDARY OF THE FLAP SURFACE/S, WHERE,  
IF(WFLAP1(N).EQ.0,0) FLAP SURFACE IS CONTINUOUS AT THE CENTER SPAN SECTION,  
IF(WFLAP1(N).LE.1,0) DISTANCE MEASURED IN SPANS;

(WFLAP2(N),N=1,NS) SPAN DISTANCE FROM PLANE OF SYMMETRY TO THE OUTER BOUNDARY OF THE FLAP OR THE INNER BOUNDARY OF THE AILERON SURFACES, WHERE,  
IF(WFLAP2(N).LE.1,0) DISTANCE MEASURED IN SPANS,

(WFLAP3(N),N=1,NS) SPAN DISTANCE FROM PLANE OF SYMMETRY TO THE OUTER BOUNDARY OF THE AILERON SURFACES, WHERE,  
IF(WFLAP3(N).LE.1,0) DISTANCE MEASURED IN SPANS,

(FLAPC(J),J=1,NSS(NS)) (OMIT FOR XQT ISURF) FLAP/S AND/OR AILERONS CHORD LENGTH FOR THE JTH,POINT OF THE REFERENCE LOFT LINE, WHERE,  
IF(FLAPC(J).LT.1,0) FLAPC(J) IS NORMALIZED BY C(J),

(FLAPC(N),N=1,NS) (OMIT FOR XQT NSURF) FLAP/S AND/OR AILERONS CHORD LENGTH FOR THE NTH,SURFACE, WHERE,  
IF(FLAPC(N).LT.1,0) FLAPC(N) IS NORMALIZED BY C(J),

(TABC(J),J=1,NSS(NS)) (OMIT FOR XQT ISURF) TAB OR AUXILIARY ELEVONS CHORD LENGTH FOR THE JTH,POINT OF THE REFERENCE LOFT LINE, WHERE,

### 3.4 INPUT INSTRUCTIONS (CONTINUED)

IF(TABC(J).LT.1) TABC(J) IS NORMALIZED BY C(J).  
(TABC(N),N=1,NS) (OMIT FOR XQT NSURF) TAB OR AUXILIARY ELEVONS CHORD LENGTH FOR THE NTH SURFACE, WHERE,  
IF(TABC(N).LT.1) TABC(N) IS NORMALIZED BY C(J).  
(FLAPDJ(N),N=1,NS) (OMIT FOR XQT ISURF) FLAP DEFLECTION (DEGREES), WHERE,  
IF(FLAPDJ(N).GT.0) FLAP DEFLECTION IS DOWN,  
IF(FLAPDJ(N).LT.0) FLAP DEFLECTION IS UP.  
(TABDJ(N),N=1,NS) (OMIT FOR XQT ISURF) TAB DEFLECTION (DEGREES), WHERE,  
IF(TABDJ(N).GT.0) TAB DEFLECTION IS DOWN,  
IF(TABDJ(N).LT.0) TAB DEFLECTION IS UP.  
((AILDJ(L,N),L=1,2), N=1,NS) (OMIT FOR XQT ISURF) AILERON DEFLECTIONS (DEGREES), WHERE, L=1 DENOTES LEFT AILERON AND L=2 DENOTES RIGHT AILERON, AND,  
IF(AILDJ(L,N).GT.0) AILERON DEFLECTION IS DOWN,  
IF(AILDJ(L,N).LT.0) AILERON DEFLECTION IS UP,  
IF(AILDJ(1,N).NE.AILDJ(2,N)) ANTISYMMETRIC LIFT,

#### **\*\* REFERENCE DIMENSIONS \*\***

**\* OMIT FOR XQT ISURF EXECUTION MODE \***

XCG (=0.0 IF OMITTED) LONGITUDINAL LOCATION OF THE CENTER OF GRAVITY MEASURED FROM THE LOFT COORDINATE SYSTEM ORIGIN.  
YCG (=0.0 IF OMITTED) SPANWISE LOCATION OF THE CENTER OF GRAVITY MEASURED FROM THE LOFT COORDINATE SYSTEM ORIGIN.  
ZCG (=0.0 IF OMITTED) VERTICAL LOCATION OF THE CENTER OF GRAVITY MEASURED FROM THE LOFT COORDINATE SYSTEM ORIGIN.  
REFS (=1000.0 IF OMITTED) REFERENCE AREA FOR NORMALIZING THE CENTER AERODYNAMIC FORCE AND MOMENT COEFFICIENTS.  
REFC (=100.0 IF OMITTED) REFERENCE CHORD FOR NORMALIZING THE CENTER AERODYNAMIC FORCE AND MOMENT COEFFICIENTS.  
REFB (=100.0 IF OMITTED) REFERENCE SPAN FOR NORMALIZING THE CENTER AERODYNAMIC FORCE AND MOMENT COEFFICIENTS.  
GSCALE (=1.0 IF OMITTED) GEOMETRY SCALING FACTOR THAT IS USED AS FOLLOWS; ALL DIMENSIONAL PHYSICAL QUANTITIES ARE MULTIPLIED BY GSCALE BEFORE EXECUTION, WITH THE EXCEPTION OF HEIGHT(N), THUS CHANGING THE SCALE OF THE INPUT GEOMETRY TO ANY DESIRED UNITS, AND, GSCALE IS SET EQUAL TO UNITY BEFORE THE NEXT JOB-RUN.

#### **\*\* FLIGHT ATTITUDE AND MULTIPLE-SURFACE SOLUTION SPECIFICATIONS \*\***

NJOB NUMBER OF SEPARATE FLIGHT CONDITIONS OR JOB RUNS TO BE CALCULATED.  
(ALFA(N),N=1,NJOB) FLIGHT ATTITUDE ANGLE OF ATTACK (DEG.), I.E., ANGLE BETWEEN FREE STREAM VELOCITY VECTOR AND THE LOFT COORDINATE SYSTEM LONGITUDINAL AXIS (X=AXIS).  
(MACHN(N),N=1,NJOB) FLIGHT MACH NUMBER BASED ON FREE STREAM SPEED OF SOUND.  
(HEIGHT(N),N=1,NJOB) ALTITUDE MEASURED FROM THE GROUND PLANE TO THE VEHICLE LOFT COORDINATE SYSTEM ORIGIN (X=Y=Z=0).

### 3.4 INPUT INSTRUCTIONS (CONTINUED)

(FLAPDJ(N),N=1,NJØB) (OMIT FOR XQT NSURF) FLAP DEFLECTION (DEGREES), WHERE,  
IF(FLAPDJ(N).GT.0) FLAP DEFLECTION IS DOWN,  
IF(FLAPDJ(N).LT.0) FLAP DEFLECTION IS UP.

((AILDJ(L,N),L=1,2), N=1,NJØB) (OMIT FOR XQT NSURF) AILERON DEFLECTIONS (DEGREES),  
WHERE, L=1 DENOTES LEFT AILERON AND L=2 DENOTES  
RIGHT AILERON, AND,  
IF(AILDJ(L,N).GT.0) AILERON DEFLECTION IS DOWN,  
IF(AILDJ(L,N).LT.0) AILERON DEFLECTION IS UP,  
IF(AILDJ(1,N).NE.AILDJ(2,N)) ANTSYMMETRIC LIFT,

((NSØLV(M,N),M=1,2) N=1,...,5) (OMIT FOR XQT NSURF) MULTIPLE SURFACE SOLUTION  
SPECIFICATION FLAG, TO BE USED AS ILLUSTRATED IN  
THE FOLLOWING EXAMPLE,  
NSØLV= 1,1, 2,2, 1,2, 1,3, 2\*0,  
MULTIPLE-SURFACE INDEPENDENT SOLUTIONS ARE OBTAINED  
FOR THE FOLLOWING COMBINATIONS,  
SURFACE 1 TO SURFACE 1 = SURFACE 1 ONLY,  
SURFACE 2 TO SURFACE 2 = SURFACE 2 ONLY,  
SURFACE 1 TO SURFACE 2 = SURFACES 1 AND 2 ONLY  
SURFACE 1 TO SURFACE 3 = SURFACES 1 THROUGH 3,

\*\* LINEARIZED THEORY LIFTING-LINE SOLUTIONS OPTION \*\*  
\* OMIT FOR XQT NSURF EXECUTION OPTION \*

NJØBL (=0 IF OMITTED) NUMBER OF LINEARIZED LIFTING LINE  
SOLUTIONS TO BE EXECUTED.  
WCL(1) = 0 OR 1 (REQUIRED INPUT IF IFLG(8).GE.1) LINEARIZED SOLUTION  
SPECIFICATION THAT IS USED AS FOLLOWS,  
IF(WCL(1).EQ.0) ALFA(J),J=1,NJØBL ARRAY CALCULATED,  
IF(WCL(1).EQ.1) WCL(J+1),J=1,NJØBL ARRAY CALCULATED  
(WCL(J+1),J=1,NJØBL) (REQUIRED INPUT IF(IFLG(8).GE.1,AND,WCL(1).GE.1)  
WING LIFT COEFFICIENT

\*\* OPTIONAL-INPUT EXECUTION CONSTANTS \*\*

CØLØCP (=0.75 IF OMITTED) COLOCATION POINT OR CONTROL POINT LOCATION  
SPECIFICATION FOR THE VORTEX LATTICE ELEMENTS, A RANGE OF  
0.75-0.83 IS GENERALLY USED.  
WSMØTH (=0.10 IF OMITTED) FLAP AND/OR AILERON DISCONTINUITY COSINE-  
SMOOTHING OPTION, WHERE,  
IF(WSMØTH.LT.1,0) WSMØTH INPUT IN SPAN UNITS,  
IF(WSMØTH.GT.1,0) WSMØTH INPUT IN PHYSICAL UNITS,  
LFLAP (=0 IF OMITTED) FLAPPED SURFACE BOUNDARY CONDITIONS FLAG, USED  
AS FOLLOWS,  
IF(LFLAP.EQ.0) EXACT GEOMETRY OF FLAP OR AILERON IS USED IN  
EVALUATING BOUNDARY CONDITIONS,  
IF(LFLAP.EQ.1) LINEARIZED-FIRST ORDER THEORY IS USED IN  
EVALUATING BOUNDARY CONDITIONS FOR THE FLAP  
OR AILERON SURFACES,

### 3.4 INPUT INSTRUCTIONS (CONTINUED)

LDRAG (=0 IF OMITTED) CALCULATION OF INDUCED DRAG FLAG, USED AS FOLLOWS,  
IF(LDRAG.EQ.0) VORTEX LATTICE SOLUTION IS OUTPUT,  
IF(LDRAG.EQ.1) LIFTING-LINE THEORY IS USED IN CALCULATING  
THE INDUCED DRAG (XQT ISURF ONLY).

CLEANF (=0.0035 IF OMITTED) SURFACE SKIN FRICTION AERODYNAMIC CLEANNESS  
FACTOR (= SF/AW) USED FOR XQT ISURF EXECUTION MODE ONLY.

PMECF (=1.0 IF OMITTED) PITCHING MOMENT EMPIRICAL CORRECTION FACTOR  
USED FOR XQT ISURF EXECUTION MODE, IF(PMECF.EQ.1), THEORETICAL  
SOLUTION IS OUTPUT.

CUTOF1 (=0.0001 IF OMITTED) CUTOFF LIMIT FOR RADIUS TO A VORTEX FILAMENT  
ELEMENT FROM A FLOW-FIELD POINT NORMALIZED BY THE VORTEX FILAMENT  
SPAN.

CUTOF2 (=0.0029 IF OMITTED) CUTOFF LIMIT FOR ANGLE (RADIAN) MEASURED  
BETWEEN A VORTEX FILAMENT AND A FLOW-FIELD POINT RELATIVE TO THE  
ORIGIN OF THE VORTEX LOCAL COORDINATE SYSTEM.

DELAFL (=1.0 IF OMITTED) ANGLE OF ATTACK INCREMENT BETWEEN THE TWO EXACT  
VORTEX-LATTICE SOLUTIONS THAT ARE GENERATED FOR DETERMINING THE  
LINEARIZED (LIFTING LINE) THEORY ARRAYS OF SOLUTIONS,

### GROUP 4 - JOB/JOB'S TERMINATION CARD

\* REQUIRED INPUT FOR NSURF AND ISURF EXECUTION MODES \*

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CARD 1           FORMAT(9H \$ENDJOBS) MUST HAVE \$ENDJOBS IN COLUMNS 2-9  
(COLUMN 1 FIELD MUST BE LEFT BLANK)

NOTE: INPUT INSTRUCTIONS FOR THE CALCOMP/4060-MICROFILM PLOT-OUTPUT OPTION,  
XQT TRWPLT, ARE FOUND IN REFERENCE 35. THESE INSTRUCTIONS HAVE BEEN  
OMITTED IN THE PRESENT REPORT.

3.5 ALPHABETICAL LIST OF INPUT QUANTITIES

VARIABLE	DIMENSION	UNITS	RESTRICTION	CLASS	DESCRIPTION AND/OR FUNCTION
AILDJ	REAL(2,5) REAL(2,10)	DEG. DEG.	NSURF ONLY ISURF ONLY	FLAP/AIL. FLAP/AIL.	AILERON-SURFACES DEFLECTION, AILERON-SURFACES DEFLECTION,
ALFA	REAL(10) REAL(20)	DEG. DEG.	NSURF ONLY ISURF ONLY	ATTITUDE ATTITUDE	ANGLE OF ATTACK, ANGLE OF ATTACK,
AW	REAL	L**2	ISURF ONLY	OPT,CONS,	WETTED AREA,
C	REAL(30) REAL(10)	L L	NSURF ONLY ISURF ONLY	SURF,PLAN SURF,PLAN	CHORD LENGTH, CHORD LENGTH,
CLEANF	REAL	NONE	ISURF ONLY	OPT,CONS,	AERODYNAMIC CLEANNESS FACTOR,
CØLØCP	REAL	NONE	NONE	OPT,CONS,	COLOCATION OR CONTROL POINT,
CUTØF1	REAL	L/R	NONE	OPT,CONS,	CUTOFF LIMIT FOR RADIUS VECTOR,
CUTØF2	REAL	RADIAN	NONE	OPT,CONS,	CUTOFF LIMIT FOR SMALL ANGLES,
DELALF	REAL	DEG.	ISURF ONLY	OPT,CONS,	ANGLE OF ATTACK INCREMENT FOR LINEARIZED THEORY,
E	REAL(30) REAL(10)	DEG. DEG.	NSURF ONLY ISURF ONLY	SURF,PLAN SURF,PLAN	CHORD PLANE GEOMETRIC TWIST, CHORD PLANE GEOMETRIC TWIST,
FLAPDJ	REAL(5) REAL(10)	DEG. DEG.	NSURF ONLY ISURF ONLY	FLAP/AIL. FLAP/AIL.	FLAP-SURFACE DEFLECTION, FLAP-SURFACE DEFLECTION,
FLAPC	REAL(30) REAL	L L	NSURF ONLY ISURF ONLY	FLAP/AIL. FLAP/AIL.	FLAP/AILERON CHORD LENGTH, FLAP/AILERON CHORD LENGTH,
GSCALE	REAL	NONE	NSURF ONLY	REF.DIM,	GEOMETRIC SCALING FACTOR,
HEIGHT	REAL(10)	L	NONE	ATTITUDE	ALTITUDE FROM GROUND PLANE,
IFLG	INTG(15)	NONE	ISURF ONLY	FLAG	JOB EXECUTION FLAG FOR ISURF,
KØUT	INTEGER	NONE	NONE	OUTPUT	BCD PRINT-OUTPUT UNIT ASSIG,
KT1	INTEGER	NONE	NONE	OUTPUT	SCRATCH/WORK BCD UNIT ASSIG,
KT2	INTEGER	NONE	NONE	OUTPUT	CALCOMP/FILM BCD UNIT ASSIG,
KT3	INTEGER	NONE	NONE	OUTPUT	SCRATCH/WORK BCD UNIT ASSIG,
L	REAL	L	NONE	NONE	LINEAR DIMENSION, E.G., FEET, INCHES,METERS,ETC,
LDRAG	REAL	NONE	ISURF ONLY	OPT,CONS,	INDUCED DRAG FACTOR,
LFLAP	REAL	NONE	NONE	OPT,CONS,	LINEAR THEORY FACTOR FOR FLAP,
LINX	INTEGER	NONE	NONE	OUTPUT	MAX,NO,LINES PER PRINTED PAGE,
MACHN	REAL(10)	NONE	NONE	ATTITUDE	FLIGHT FREE-STREAM MACH NUMBER,
NCS	INTG(5)	NONE	NONE	AIRFOIL	NO,OF CHORD STATIONS,
NFLG	INTG(20)	NONE	NSURF ONLY	FLAG	JOB EXECUTION FLAG FOR NSURF,
NFUS	INTEGER	NONE	NSURF ONLY	SURF,TYPE	NO,SYMMETRIC FUS, SURFACES,
NJØB	INTEGER	NONE	NONE	ATTITUDE	NO,OF FLIGHT ATTITUDES,

3.5 ALPHABETICAL LIST OF INPUT QUANTITIES (CONTINUED)

VARIABLE	DIMENSION	UNITS	RESTRICTION	CLASS	DESCRIPTION AND/OR FUNCTION
NJ0BL	INTEGER	NONE	ISURF ONLY	LINEAR OPT	NO, OF SEPARATE FLIGHT ATTITUDES FOR LIFTING-LINE SOLUTIONS,
NS0LV	INTG(12)	NONE	NSURF ONLY	ATTITUDE	MULTIPLE-SURFACE SOLUTION FLAG,
NSS	INTG(5)	NONE	NONE	SURF, PLAN	STORAGE ALLOCATION-ORDER INDEX,
NVTAIL	INTEGER	NONE	NSURF ONLY	SURF, TYPE	NO, VERT, ANTI-SYMM, SURFACES,
NWING	INTEGER	NONE	NSURF ONLY	SURF, TYPE	NO, SYMMETRIC WING SURFACES,
PMECF	REAL	NONE	ISURF ONLY	OPT, CONS.	PITCHING MOMENT FACTOR,
REFB	REAL	L	NSURF ONLY	REF, DIM.	REFERENCE SPAN LENGTH,
REFC	REAL	L	NSURF ONLY	REF, DIM.	REFERENCE CHORD LENGTH,
REFS	REAL	L**2	NSURF ONLY	REF, DIM.	REFERENCE AREA,
SF	REAL	L**2	ISURF ONLY	OPT, CONS	EQUIVALENT FLAT PLATE AREA,
TABC	REAL(30)	L	NSURF ONLY	FLAP/AIL.	TAB CHORD LENGTH,
TABDJ	REAL(5)	DEG,	NSURF ONLY	FLAP/AIL.	TAB-SURFACE DEFLECTION,
WCL	REAL(21)	NONE	ISURF ONLY	LINEAR OPT	WING LIFT COEFFICIENT FOR LIFTING LINE SOLUTIONS,
WFLAP1	REAL(5)	L	NONE	FLAP/AIL.	FLAP SPAN INNER-EDGE DIM,
WFLAP2	REAL(5)	L	NONE	FLAP/AIL.	AILERON SPAN INNER-EDGE DIM,
WFLAP3	REAL(5)	L	NONE	FLAP/AIL.	AILERON SPAN OUTER-EDGE DIM,
WSM0TH	REAL	L	NONE	OPT, CONS.	COSINE SMOOTHING SCALE,
XCG	REAL	L	NSURF ONLY	REF, DIM.	LONGITUDINAL LOCATION OF C,G,
X	REAL(30) REAL(10)	L L	NSURF ONLY ISURF ONLY	SURF, PLAN SURF, PLAN	REF, LOFT LINE X-COORDINATE, REF, LOFT LINE X-COORDINATE,
X0C	REAL(10,5) REAL(10)	L/C L/C	NSURF ONLY ISURF ONLY	AIRFOIL AIRFOIL	CHORD STATION FOR AIRFOIL SECT, CHORD STATION FOR AIRFOIL SECT,
X0CR	REAL(30) REAL	L/C L/C	NSURF ONLY NSURF ONLY	SURF, PLAN SURF, PLAN	RELATIVE LOCATION OF REF,LOFT LINE, RELATIVE LOCATION OF REF,LOFT LINE,
Y	REAL(30) REAL(10)	L L	NSURF ONLY ISURF ONLY	SURF, PLAN SURF, PLAN	REF, LOFT LINE Y-COORDINATE, REF, LOFT LINE Y-COORDINATE,
YCG	REAL	L	NSURF ONLY	REF, DIM.	SPANWISE LOCATION OF C,G,
YSPAN	REAL(42)	L	ISURF ONLY	SURF, PLAN	SPAN STATIONS THAT BOUND VORTEX LATTICE ELEMENTS,
Z	REAL(30) REAL(10)	L L	NSURF ONLY ISURF ONLY	SURF, PLAN SURF, PLAN	REF, LOFT LINE Z-COORDINATE, REF, LOFT LINE Z-COORDINATE,
ZCG	REAL	L	NSURF ONLY	REF, DIM.	VERTICAL LOCATION OF C,G,
Z0C	REAL(10,30) REAL(10,10)	L/C L/C	NSURF ONLY ISURF ONLY	AIRFOIL AIRFOIL	MEAN CAMBER FOR AIRFOIL SECT, MEAN CAMBER FOR AIRFOIL SECT,

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**3.6 LIST OF ABBREVIATIONS FOR INPUT**

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AIL	AILERON
ASSIG.	ASSIGNMENT
CONS.	CONSTANT
C,G.	CENTER OF GRAVITY
DEG.	DEGREES, ANGULAR MEASURE
DIM.	DIMENSION
.EQ.	EQUAL
E,G.	FOR EXAMPLE
.GE.	GREATER OR EQUAL
.GT.	GREATER THAN
IABS	ABSOLUTE VALUE OF AN INTEGER CONSTANT
INTG	INTEGER
I,E.	EQUIVALENT TO
.LE.	LESS OR EQUAL
.LT.	LESS THAN
OPT.	OPTIONAL
REF	REFERENCE
SURF.	SURFACE
*	MULTIPLICATION
**	EXPONENTIATION

1.0 PROGRAM DATA TABLES

TABLE 4.01 - INITIAL VALUES

VARIABLE	DIMENSION	RESTRICTION	INITIAL VALUE/S
AILDJ	REAL(2,5) REAL(2,10)	NSURF ONLY ISURF ONLY	10*0.0, 20*0.0,
ALFA	REAL(10) REAL(20)	NSURF ONLY ISURF ONLY	10*0.0, 20*0.0,
C	REAL(30) REAL(10)	NSURF ONLY ISURF ONLY	2*100.0, 28*0.0, 10*100.0,
CLEANF	REAL	ISURF ONLY	0.0035,
COLBGP	REAL	NONE	0.75,
CUTBF1	REAL	NONE	0.0001,
CUTBF2	REAL	NONE	0.0029,
DELAFL	REAL	ISURF ONLY	1.0,
E	REAL(30) REAL(10)	NSURF ONLY ISURF ONLY	30*0.0, 10*0.0,
FLADJ	REAL(5) REAL(10)	NSURF ONLY ISURF ONLY	5*0.0, 10*0.0,
FLAPC	REAL(30) REAL	NSURF ONLY ISURF ONLY	30*0.25, 0.3,
GSCALE	REAL	NSURF ONLY	1.0,
HEIGHT	REAL(10)	NONE	10*1.0E+5,
IFLG	INTG(15)	ISURF ONLY	0,0,10,0,0,1,0,0,0,1,0,0,0,0,0,
KOUT	INTEGER	NONE	6,
KT1	INTEGER	NONE	1,
KT2	INTEGER	NONE	8,
KT3	INTEGER	NONE	3,
LDRAG	INTEGER	ISURF ONLY	0,
LFLAP	INTEGER	NONE	0,
LINX	INTEGER	NONE	56,
MACHN	REAL(10)	NONE	10*0.0,
MCS	INTG(5) INTEGER	NSURF ONLY ISURF ONLY	2,4*0, 2,

TABLE 4.01 - INITIAL VALUES (CONTINUED)

VARIABLE	DIMENSION	RESTRICTION	INITIAL VALUE/S
NFLG	INTG(20)	NSURF ONLY	10,0,0,0,0,4,0,0,0,0,0,0,0,0,0,0,0,1,0,4,
NFUS	INTEGER	NSURF ONLY	0,
NJØB	INTEGER	NONE	1,
NJØBL	INTEGER	ISURF ONLY	20,
NSØLV	INTG(12)	NSURF ONLY	1,1,10*0,
NSS	INTG(5) INTEGER	NSURF ONLY ISURF ONLY	2,4*0, 2,
NVTAIL	INTEGER	NSURF ONLY	0,
NWING	INTEGER	NSURF ONLY	1,
PMECF	REAL	ISURF ONLY	1,0,
REFB	REAL	NSURF ONLY	100,0,
REFC	REAL	NSURF ONLY	100,0,
REFS	REAL	NSURF ONLY	1000,0,
TABC	REAL(30)	NSURF ONLY	30*0,125,
TABDJ	REAL(5)	NSURF ONLY	5*0,0,
WCL	REAL(21)	ISURF ONLY	+1,0,-0,4,-0,3,-0,2,-0,1,+0,0,+0,1, +0,2,+0,3,+0,4,+0,5,+0,6,+0,7,+0,8, +0,9,+1,0,+1,1,+1,2,+1,3,+1,4,+1,5,
WFLAP1	REAL(5) REAL	NSURF ONLY ISURF ONLY	5*0,0, 0,0,
WFLAP2	REAL(5) REAL	NSURF ONLY ISURF ONLY	5*0,6, 0,6,
WFLAP3	REAL(5) REAL	NSURF ONLY ISURF ONLY	5*1,0, 1,0,
WSMØTH	REAL REAL	NSURF ONLY ISURF ONLY	0,1, 0,2,
XCG	REAL	NSURF ONLY	0,0,
X	REAL(30) REAL(10)	NSURF ONLY ISURF ONLY	30*0,0, 10*0,0,
XØC	REAL(10,5) REAL(10)	NSURF ONLY ISURF ONLY	0,0,1,0,48*0,0, 0,0,1,0,8*0,0,

TABLE 4.01 - INITIAL VALUES (CONTINUED)

VARIABLE	DIMENSION	RESTRICTION	INITIAL VALUE/S
X0CR	REAL(30) REAL	NSURF ONLY ISURF ONLY	30*0,25, 0,25,
Y	REAL(30) REAL(10)	NSURF ONLY ISURF ONLY	30*0,0, 0,0,100,0,8*1000,0,
YCG	REAL	NSURF ONLY	0,0,
YSPAN	REAL(42)	ISURF ONLY	42*0,0,
Z	REAL(30) REAL(10)	NSURF ONLY ISURF ONLY	30*0,0, 10*0,0,
ZCG	REAL	NSURF ONLY	0,0,
ZDC	REAL(10,30) REAL(10,10)	NSURF ONLY ISURF ONLY	300*0,0, 100*0,0,

## 5.0 OUTPUT

### 5.1 General Description of Output

The printed-output and tape-output for the main execution modes of the program are organized in the following manner.

#### 1) Raw Data

The input data for all the case studies that are to be executed by the computer which includes punched card data up to and including the \$ENDJ0BS card is printed in the first page or pages in the exact form it was read into the computer, i.e., raw data including punched-card errors, etc.

#### 2) Initial Values

For each individual case study to be executed the job-execution flags, geometry data, flight data, etc. are output via NAMELIST statement, i.e., the values of all the input variables are output via \$INPUT.

#### 2) Short-Print Output (NFLG(20) or IFLG(10) = 0)

The following tables are output under the short-print output option:

<u>Table Title &amp; Description</u>	<u>Table # in Section 5.2</u>
Lifting-Surface Geometry (one for each surface)	Table 5.01
Camber for Airfoil Section (one for each surface)	Table 5.02
Section Airload Coefficients (one for each surface)	Table 5.03
Spatially-Integrated Airload Coefficients	Table 5.04
Linearized (Lifting-Line) Solutions (ISURF execution mode only)	Table 5.05
Job/Jobs Termination Output	Table 5.06

#### 4) Long-Print Output (NFLG(20) or IFLG(10) ≥ 2)

The short-print tables and the following tables are output under the long-print option:

<u>Table Title &amp; Description</u>	<u>Table # in Section 5.2</u>
Vortex-Lattice Geometry Detail (one for each surface)	Table 5.07
Lift Distribution Detail (one for each surface)	Table 5.08

### 5.1 General Description of Output (Continued)

#### 5) Debug-Print Output (NFLG(20) or IFLG(10) $\geq$ 5)

In addition to the short-print and long-print tables, the following tables are output under the debug-print option

<u>Table Title &amp; Description</u>	<u>Table # in Section 5.2</u>
Vortex-Lattice Induced Velocity	Table 5.09
Matrices Detail (one for each surface)	

#### 6) Program Checkout-Print Output (NFLG(20) or IFLG(10 $\geq$ 16))

Under the program checkout-print option, detail data on the vortex-lattice velocity induced for each individual vortex filament is output via NAMELIST statement, accordingly

<u>Table Title &amp; Description</u>	<u>Table # in Section 5.2</u>
Program Checkout & Debug Print	Table 5.10

#### 7) Tape Output (NFLG(19) or IFLG (11) through IFLG(14) $>$ 1)

A summary of the analytical solutions generated by the program is output on magnetic tape. This output is used by the auxiliary execution mode (TRWPLT) for generating 4060-microfilm or Calcomp output. A detailed description of the format and variables output on tape is presented in Section 5.3.

#### 8) Execution Diagnostics and Job Abort Output

See Section 5.4.

#### 9) Alphabetical List of Output Quantities

See Section 5.5.

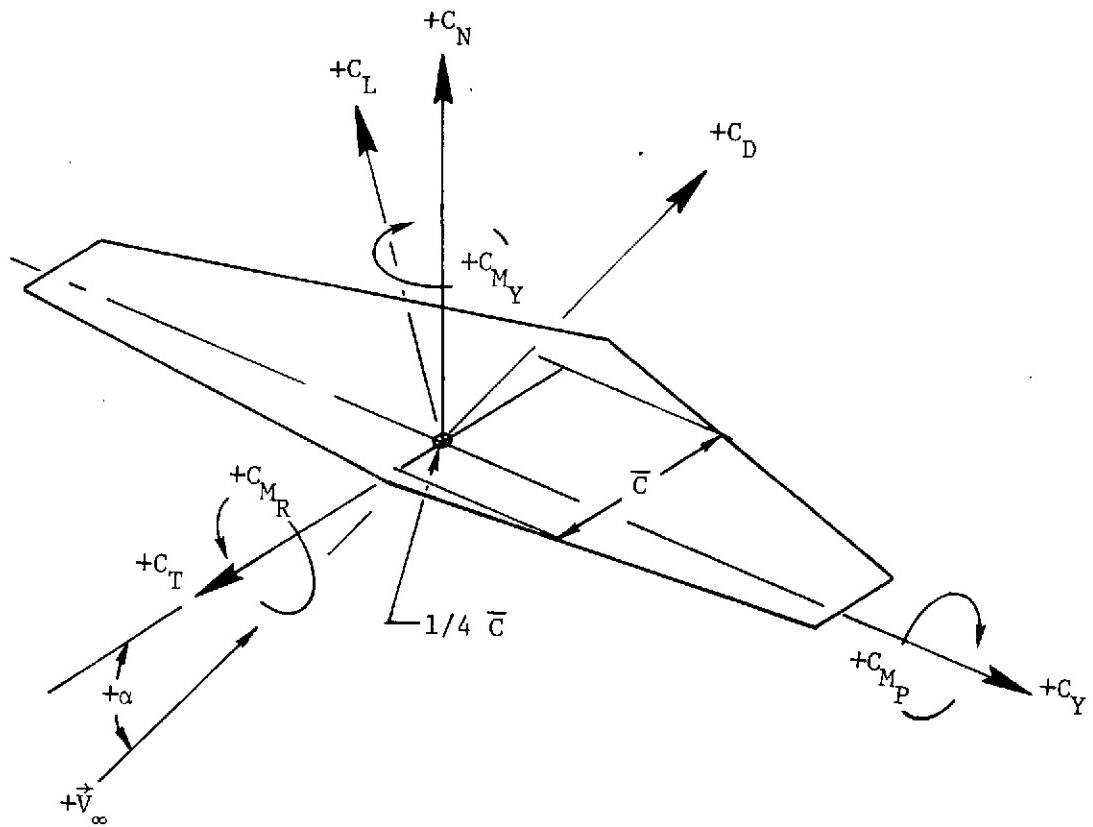
#### 10) List of Abbreviations for Output

See Section 5.6.

#### 11) Sign Conventions for Output

The sign conventions adopted for output purposes are described in Figure 5.01 (Page 5-3).

A) AIRLOAD AND MOMENT COEFFICIENTS



B) LIFTING-SURFACE GEOMETRY

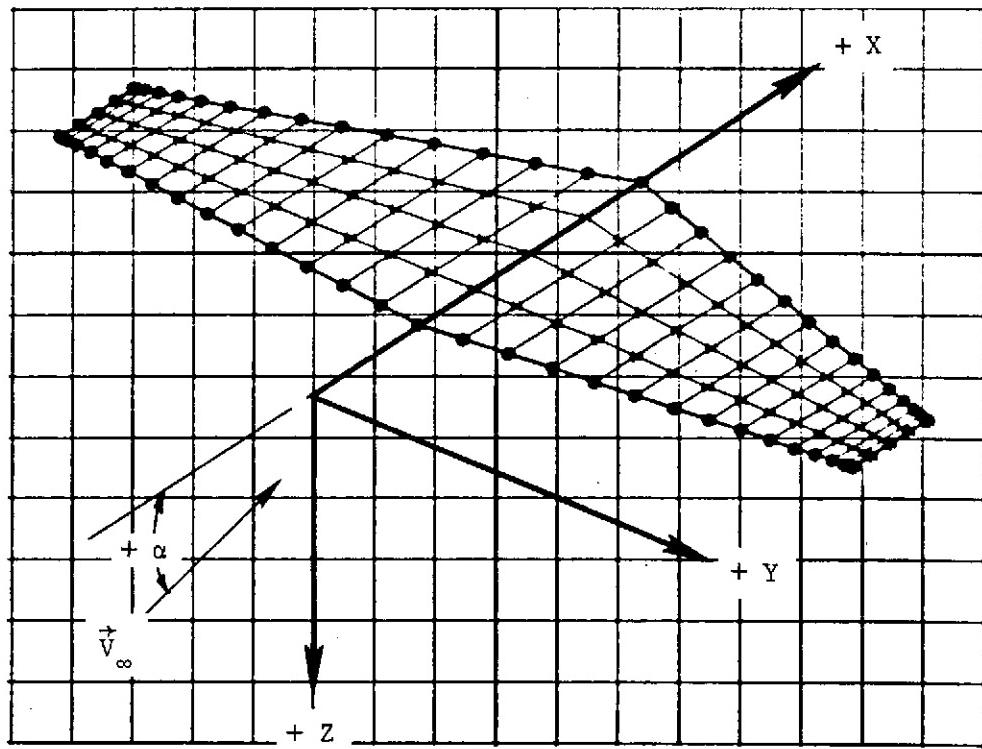


FIGURE 5.01 - LIFTING-SURFACE SOLUTIONS SIGN CONVENTIONS FOR OUTPUT

## 5.2 Printed-Output Format Summary

### 1) Short-Print Output

TABLE 5.01 - LIFTING-SURFACE GEOMETRY (One for Each Surface)

LIFTING SURFACE NC = N												
SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)	
b	$c_R$	$c_T$	$\epsilon_R$	$\epsilon_T$	S	AR	$c_{mean}$	$\bar{c}$	$\bar{y}$	$\bar{x}$	$\bar{z}$	
FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	CIMED. MGC/4	SWEPP MGC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.	
$y_1$	$y_2$	$y_3$	$\delta_f$	$\delta_{tab}$	$\delta_{LA}$	$\delta_{RA}$	$\phi(\bar{c}/4)$	$\Lambda(\bar{c}/4)$	NSE	NCE	NCD	
			FUS STA X(CG)	WING STA Y(CG)	WL STA Z(CG)	ARFA S(CG)	CHORD C(CG)	SPAN B(CG)				
			$x_{ref}$	$y_{ref}$	$z_{ref}$	$s_{ref}$	$\bar{c}_{ref}$	$b_{ref}$				
WS	Y	Z	X(LF)	X(C/4)	X(TE)	TWIST	DIMED(C/4)	SWEPP(C/4)	C(WING)	C(FLAP)	C(TAB)	
w	y	z	$x_{LE}$	$x(\bar{c}/4)$	$x_{TE}$	$\epsilon$	$\phi(c/4)$	$\Lambda(c/4)$	c	$c_f$	$c_{tab}$	

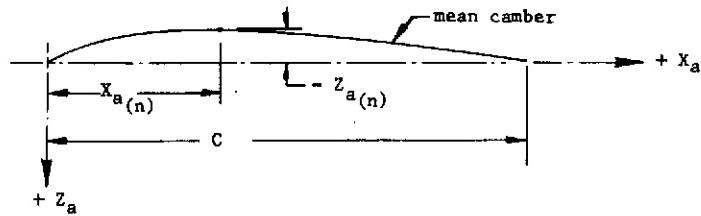
## 5.2 Printed-Output Format Summary (Continued)

TABLE 5.02 - AIRFOIL-SECTION CAMBER (One for Each Surface)

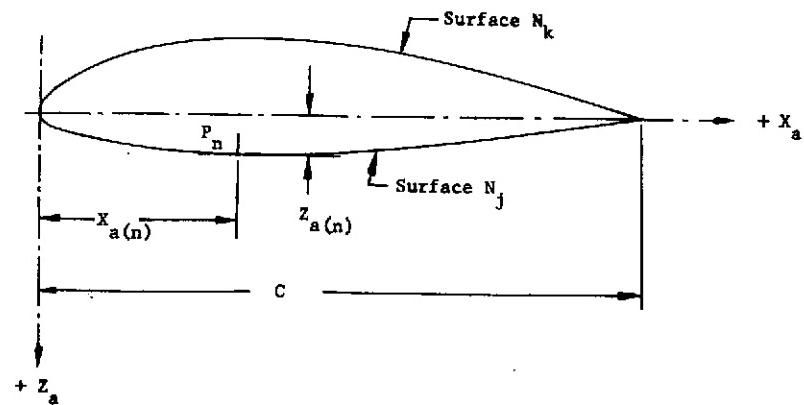
	X	Y	XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C
			ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
x												
y												
z												

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[A] Single-Surface Representation



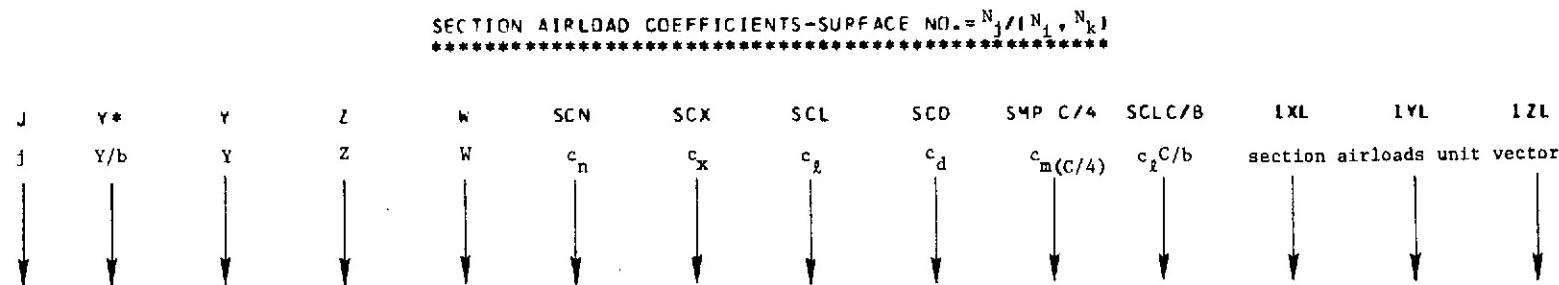
[B] Two-Surface Representation



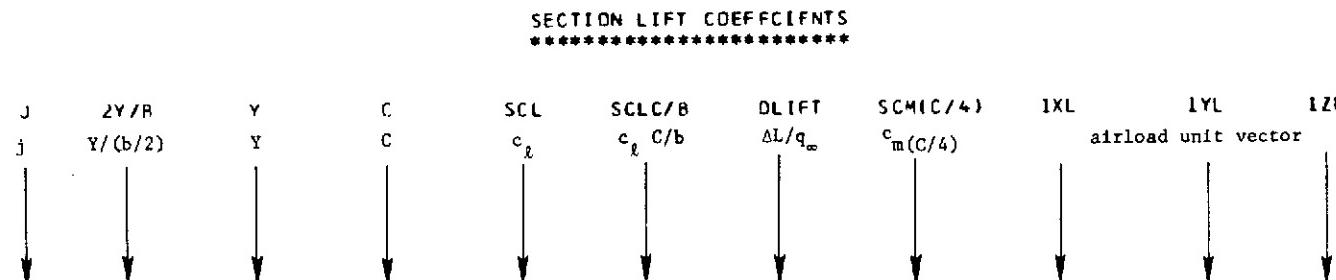
## 5.2 Printed-Output Format Summary (Continued)

TABLE 5.03 - SECTION AIRLOAD COEFFICIENTS (One for Each Surface)

### [A] NSURF Execution Mode



### [B] ISURF Execution Mode



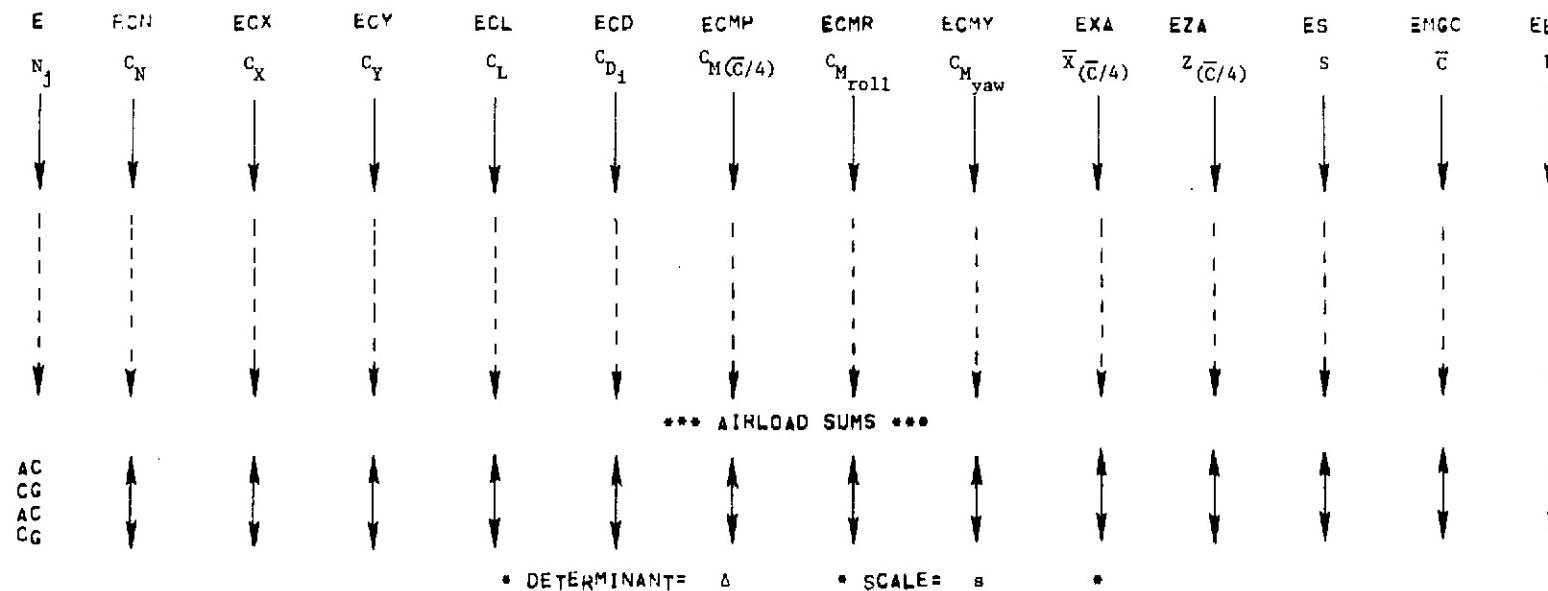


## 5.2 Printed-Output Format Summary (Continued)

TABLE 5.04 - SPATIALLY-INTEGRATED AIRLOAD COEFFICIENTS

### [A] NSURF Execution Mode

**INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS. =  $N_1$  -  $N_k$**



### [B] ISURF Execution Mode

## WING AIRLOAD COEFFICIENTS

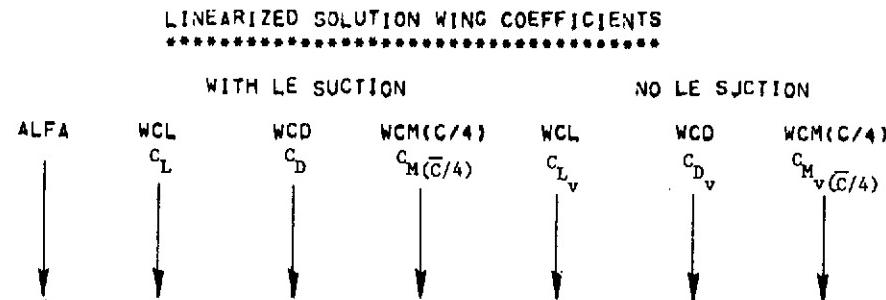
WCL WCDI WCMP WCMR WCMY IXL IYL IZL DELTA SCALE  
 WITH LF SUCTION NO LF SUCTION C<sub>L</sub> C<sub>D<sub>i</sub></sub> C<sub>M(C/4)</sub> C<sub>M</sub> roll C<sub>M</sub> yaw ↓ airload unit vector Δ s

Note: Starred entries in the table (\*) refer to calculated values of vortex-lift increments.

## 5.2 Printed-Output Format Summary (Continued)

TABLE 5.05 - LINEARIZED (LIFTING-LINE) SOLUTIONS (ISURF Execution Mode Only)

### [A] Basic Lift Distribution



### [B] Linearized Solutions

LINEARIZED SOLUTION WITH LE SUCTION  
\*\*\*\*\*

ALFA	ALFA0	WCL	WCL SLOPE	CMP SLOPE	CMR SLOPE	CMY
$\alpha$	$\alpha_0$	$c_L$	$\bar{m}$	$\bar{m}_{pitch}$	$\bar{m}_{roll}$	$\bar{m}_{yaw}$
WITH LE SUCTION						
$y$	$2y/b$	SCL $c_L$	SCDI $c_{d_i}$	SCM(C/4) $c_m(C/4)$	SCL $c_{L_v}$	SCDI $c_{d_{i,v}}$
$y$	$y/(b/2)$	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$
NO LE SUCTION						
$y$						
FLAP/AILERON						
$y$						
WITH LE SUCTION		$WCL = c_L$	$/ WCDI = c_{D_i}$	$/ WCM(C/4) = c_{M(\bar{C}/4)}$	$/ L/D = c_L/c_{D_i}$	
NO LE SUCTION						

## 5.2 Printed-Output Format Summary (Continued)

TABLE 5.05 - LINEARIZED (LIFTING-LINE) SOLUTIONS (Continued)

### [C] Spatially-Integrated Linearized Solutions

LINEARIZED SOLUTION WITH LE SUCTION						
ALFA	ALFARD	WCL	WCL SLOPE	CMD SLOPE	CMR SLOPE	CMY
$\alpha$	$\alpha R_0$	$c_L$	$\bar{m}$	$\bar{m}_{pitch}$	$\bar{m}_{roll}$	$\bar{m}_{yaw}$
$Y$	$2Y/B$	$SCLAI$	$SCLB$	$SCL$	$SCM(1/4)$	
$Y$	$Y/(b/2)$	$c_{lal}$	$c_{lb}$	$c_l$	$c_m(c/4)$	
↓	↓	↓	↓	↓	↓	↓

TABLE 5.06 - JOB/JOBS TERMINATION OUTPUT

### [A] NSURF Execution Mode

```
**** JOB TIME= t1 / ELAPSED TIME= t2 / NO.PLOT FILES= np / NSURF EXEC. VFRSION 6-18-72 ****
*****
```

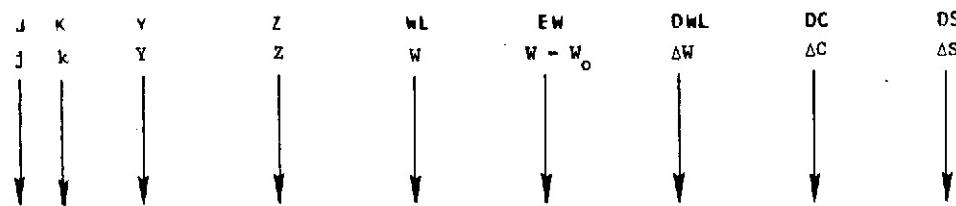
### [B] ISURF Execution Mode

```
**** JOB TIME= t1 / ELAPSED TIME= t2 / NO.PLOT FILES= np / ISURF EXEC. VERSION 6-18-72 ****
*****
```

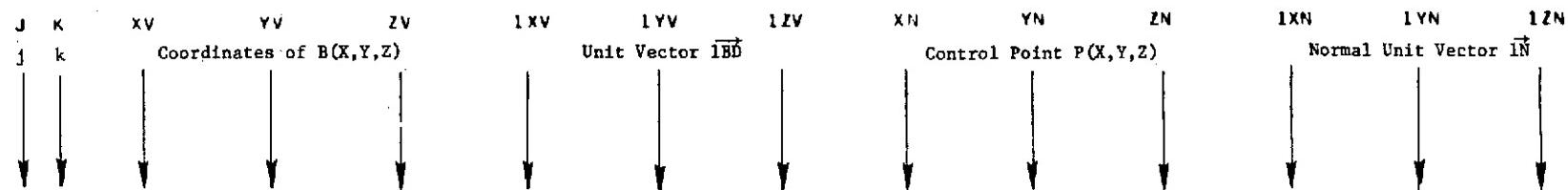
## 5.2 Printed-Output Format Summary (Continued)

### 2) Long-Print Output

TABLE 5.07 - VORTEX-LATTICE GEOMETRY DETAIL (One for Each Surface)

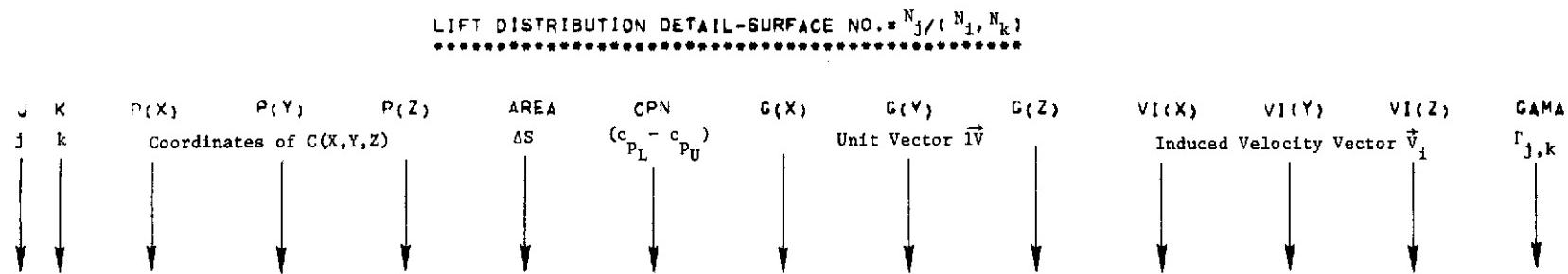


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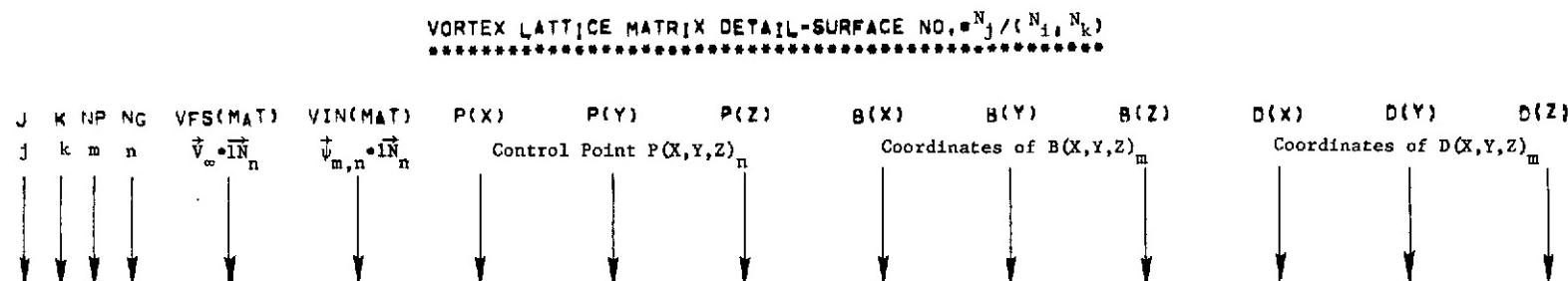
## 5.2 Printed-Output Format Summary (Continued)

TABLE 5.08 - LIFT DISTRIBUTION DETAIL (One for Each Surface)



### 3) Debug-Print Output

TABLE 5.09 - VORTEX-LATTICE INDUCED VELOCITY MATRICES DETAIL (One for Each Surface)



## 5.2 Printed-Output Format Summary (Continued)

### 4) Program Checkout and Debug Print Output

TABLE 5.10 - PROGRAM CHECKOUT AND DEBUG PRINT

#### [A] Induced Velocity Calculation Detail-Print

Origin: Subroutine VØRTEX (A13 or B11)

```
$DBUGV1
P      = P(X,Y,Z)
B      = B(X,Y,Z)
D      = D(X,Y,Z)
TANA   = Tan( $\alpha$ )
GAMA   =  $\Gamma$ 
PSIF   =  $\psi$ 
VCOS   =  $\vec{V}_i$ 
$END
```

Branch  $\infty$ -A-B

```
$DBUGV2
PSIF   =  $\psi$ 
VCOS   =  $\vec{V}_i$ 
$END
```

Branch D-E- $\infty$

```
$DBUGV3
PSIF   =  $\psi$ 
VCOS   =  $\vec{V}_i$ 
$END
```

Branch B-C-D

#### [B] Ground Effect Mirror Image Calculation Detail-Print

Origin: Subroutine REFLEC (A10 or B12)

```
$REFLEX
PX     = X of P(X,Y,Z)
PY     = Y of P(X,Y,Z)
X1     = X coordinate for intermediate point
Y1     = Y coordinate for intermediate point
PHI    =  $\phi$ , rotation angle (radians)
ALFAR  =  $\alpha$ , angle of attack (radians)
RX     = X coordinate of mirror-image point
RY     = Y coordinate of mirror-image point
ZL     = Z coordinate to ground plane
COSR   = Cos( $\phi$ )
$END
```

### 5.3 Tape-Output Format Summary

In exercising the Calcomp/4060-microfilm plot-option of the program through the execution of XQT TRWPLT, the auxiliary execution mode, a data tape (or an internal unit) has to be provided in addition to the plotting instructions. The data tape is generated in the main execution modes of program, XQT NSURF or XQT ISURF, when the tape output option is specified in the input, i.e., NFLG(19) ≠ 0 or IFLG(12), IFLG(13), and IFLG(14) ≠ 0. The data in the data-tape is organized into a number of separate files, each file containing a single solution or a separate class of information. The data in each file is organized as illustrated below:

Execution Mode	File No.	Type of Information	Reference	
NSURF	#1	Geometry for 1st. Surface	Example #1 (Section 6.2)	
	#2	Geometry for 2nd. Surface		
	#3	Geometry for 3rd. Surface		
	#4	Geometry for 4th. Surface		
	#5			
	#6	Geometry for 5th. Surface		
	#7			
ISURF	#1	Geometry for 1st. Surface	Example #2 (Section 6.3)	
	#2	Chordwise pressure distribution		
	#3	Spanwise airload distribution		
	#4	Linearized airload solution		

The data record format adopted for each file is given by

IREC, N, DATA<sub>1</sub>, DATA<sub>2</sub>, ..., DATA<sub>N</sub>,

IREC, N, DATA<sub>1</sub>, DATA<sub>2</sub>, ..., DATA<sub>N</sub>,

" " " "

" " " "

END OF FILE

where

IREC is the record type or number

N is the number of variables

DATA<sub>i</sub> is the i<sup>th</sup> variable in the record

The definition of the variables that are output in the data-tape is presented in Table 5.11.

TABLE 5.11 - TAPE-OUTPUT FORMAT SUMMARY

File	Execution Mode	Origin Routine No.	Record No. IREC	No. Words N	Data	Function
i	NSURF	A03	1	6	$X_{LE}, Y_{LE}, Z_{LE}, X_{TE}, Y_{TE}, Z_{TE},$	Isometric Projection of the $N^{\text{th}}$ Lifting-Surface Geometry
			2	3	$X_{F1}, Y_{F1}, Z_{F1},$	
			3	3	$X_{F2}, Y_{F2}, Z_{F2},$	
j	ISURF	B03	1	7	$Y, X_{LE}, X_{C/4}, X_{TE}, X_{HF}, C_w, C_F,$	Orthographic Projection of the $I^{\text{th}}$ Lifting-Surface Geometry
			2	2	$Y_{F1}, X_{F1},$	
			3	2	$Y_{F2}, X_{F2},$	
			4	3	$Y, Z_{LE}, Z_{TE},$	Isometric Projection of the $I^{\text{th}}$ Lifting-Surface Geometry
			5	6	$X_{LE}, Y_{LE}, Z_{LE}, X_{TE}, Y_{TE}, Z_{TE},$	
			6	3	$X_{F1}, Y_{F1}, Z_{F1},$	
			7	3	$X_{F2}, Y_{F2}, Z_{F2},$	
k	ISURF	B05	1	2	$X/C, (c_{p_U} - c_{p_L})$	Chordwise Pressure Distribution
			2	10	$Y/b, c_l, c_d, c_m(C/4), c_{n_f}, c_{x_f}, c_{h_f}, c_{l_v}, c_{d_v}, c_{m_v}(C/4),$	Span Distribution of Section Airload Coefficients for Vortex-Lattice Solution
l	ISURF	B06	1	10	$Y/b, c_l, c_d, c_m(C/4), c_{n_f}, c_{x_f}, c_{h_f}, c_{l_v}, c_{d_v}, c_{m_v}(C/4)$	Span Distribution of Section Airload Coefficients for Linearized Solutions
			2	7	$\alpha, c_L, c_D, c_M(\bar{C}/4), c_{L_v}, c_{D_v}, c_{M_v}(\bar{C}/4)$	Spatially-Integrated Airload Coefficients

## 5.4 Execution Diagnostics and Job Abort Output

Aside from the system (the computer) diagnostic error messages that may be output in the normal execution of the program, diagnostic or job termination messages are output when unallowable errors are incurred in the execution. Generally, these errors result because of bad input or because some of the calculated dependent variables fall outside the range of the program. A complete list of the error messages that may be output by the program and the corrective action that should be taken for each individual case is presented below:

### 1) JOB ABORTED BECAUSE, NO. OF LIFTING SURFACES = N EXCEEDS FIVE

Origin: Subroutine L<sup>O</sup>FT (A03)

Cause: The number of lifting surfaces specified in the input exceeds the maximum number of lifting surfaces allowed in execution.

Correction: The absolute value sum of NWING, NFUS, and NVTAIL must be less than or equal to five. Revise accordingly.

### 2) JOB ABORTED BECAUSE, NO. OF SPAN ELEMENTS = NSE EXCEEDS 60

Origin: Subroutine L<sup>O</sup>FT (A03)

Cause: The number of spanwise elements of the vortex-lattice geometric configuration exceeds the maximum number of allowable elements.

Correction: Decrease the number of spanwise elements in the vortex-lattice by revising the entries in NFLG(1), NFLG(2), ..., NFLG(5).

### 3) JOB ABORTED BECAUSE, NO. OF CHORD ELEMENTS = NCE EXCEEDS TEN

Origin: Subroutine L<sup>O</sup>FT (A03)

Cause: The vortex-lattice number of chordwise elements assigned to the  $N^{\text{th}}$  surface exceeds the maximum allowable number.

Correction: The value assigned to NFLG(6), NFLG(7), or, NFLG(10) cannot exceed 10. Revise these entries accordingly.

#### 5.4 Execution Diagnostics and Job Abort Output (Continued)

4) JOB ABORTED BECAUSE, NO. OF VORTEX-LATTICE ELEMENTS = NVME EXCEEDS 100

Origin: Subroutine LIFTX (A04)

Cause: Too many elemental panels are considered simultaneously in obtaining a solution, i.e., the number of elements in the induced-velocity matrix exceeds the maximum allowable number.

Correction: A smaller number of lifting-surfaces or a smaller number of elemental panels per surface has to be considered in obtaining a solution. To achieve these objectives revise the entries made for NSOLV, and NFLG(1) through NFLG(10).

5) JOB ABORTED BECAUSE, MACH NO. = MACHN EXCEEDS 0.90

Origin: Subroutine MAIN (A01)

Cause: The free stream Mach Number assigned to a given solution exceeds the maximum allowable limit of the program.

Correction: Revise the entries made for the MACHN array.

6) JOB ABORTED BECAUSE, NO. OF SPAN STATIONS = NSS EXCEEDS 30

Origin: Subroutine LOFT (A03)

Cause: Too much data input for the X, Y, Z, E, C, and XOCR arrays.

Correction: Revise entries for NSS, X, Y, Z, E, C, and XOCR.

7) JOB ABORTED BECAUSE, NO. OF CHORD STATIONS = NSC EXCEEDS 10

Origin: Subroutine LOFT (A03)

Cause: Too much data input for XOC and ZOC arrays.

Correction: Revise entries for NCS, XOC, and ZOC.

8) JOB ABORTED BECAUSE, NO. OF SPAN ELEMENTS = NSPE NOT PERMITTED

Origin: Subroutine LOFT (A03)

Cause: The number of span elements assigned to any lifting surface has to be a positive integer.

Correction: Revise (increase) entries for NFLG(1), through NFLG(5).

#### 5.4 Execution Diagnostics and Job Abort Output (Continued)

##### 9) JOB ABORTED BECAUSE, NO. OF WING CHORD ELEMENTS = NWCE NOT PERMITTED

Origin: Subroutine L<sup>O</sup>FT (A03)

Cause: Too few chordwise elements assigned to the N<sup>th</sup> lifting surface.

Correction: Revise (increase) entries for NFLG(6) through NFLG(10).

##### 10) JOB ABORTED BECAUSE, INPUT ERROR IN NSS FLAG, NSS(N) = I1.LT.NSS(M)=12

Origin: Subroutine L<sup>O</sup>FT (A03)

Cause: Input error incurred in the NSS array specification.

Correction: Revise entries for NSS array.

## 5.5 ALPHABETICAL LIST OF OUTPUT QUANTITIES

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\* PROGRAM OUTPUT OPTIONS \*

---

- |                           |                                     |
|---------------------------|-------------------------------------|
| (1) - SHORT-PRINT OUTPUT, | NFLG(20),OR,IFLG(10),EQ,0,          |
| (2) - LONG-PRINT OUTPUT,  | NFLG(20),OR,IFLG(10),GE,2,          |
| (3) - DEBUG-PRINT OUTPUT, | NFLG(20),OR,IFLG(10),GE,5,          |
| (4) - PROGRAM-CHECKOUT;   | NFLG(20),OR,IFLG(10),GE,8,          |
| (5) - PLOT TAPE OUTPUT,   | NFLG(19),OR,(IFLG(I),I=11,14),GE,1. |

\* INPUT-DATA OUTPUT - NAMELIST INPUT \*

---

NAMELIST INPUT. SEE INPUT VARIABLES LIST (SECTION 3.4) FOR DEFINITION OF INPUT VARIABLES IN NAMELIST INPUT.

\* STANDARD-PRINT OUTPUT - SHORT-PRINT, LONG-PRINT, OR DEBUG-PRINT \*

---

VARIABLE	COMMENT	UNITS <sup>†</sup>	DEFINITION
AC	INTG,COEFF,		AERODYNAMIC CENTER FOR ELEMENTAL SURFACE NO. 1.
ALFA		DEG,	ANGLE OF ATTACK MEASURED RELATIVE TO THE FREE STREAM VECTOR AND THE X-COORDINATE AXIS.
ALFARD	ISURF	DEG,	WING ANGLE OF ATTACK FOR CL=0,0.
ALTITUDE		L	ALTITUDE ABOVE THE GROUND PLANE, I.E., THE SHORTEST STRAIGHT-LINE DISTANCE MEASURED FROM THE COORDINATE SYSTEM ORIGIN (X=Y=Z=0) TO THE GROUND PLANE.
AREA	GEOMETRY	L**2	PROJECTED AREA OF LIFTING SURFACE.
AREA	ND.GE,2	L**2	AREA OF AN ELEMENTAL SURFACE.
AREA S(CG)	GEOMETRY	L**2	REFERENCE AREA USED FOR NORMALIZING THE C.G. AERODYNAMIC COEFFICIENTS.
ASPECT RATIO	GEOMETRY		ASPECT RATIO OF LIFTING SURFACE, I.E., EQUAL TO (SPAN**2)/AREA
B(X)	ND.GE,5	L	X-COORDINATE OF POINT B(X,Y,Z) THAT DEFINES THE GEOMETRY OF THE VORTEX FILAMENT B-D.
B(Y)	ND.GE,5	L	Y-COORDINATE OF POINT B(X,Y,Z) THAT DEFINES THE GEOMETRY OF THE VORTEX FILAMENT B-D.
B(Z)	ND.GE,5	L	Z-COORDINATE OF POINT B(X,Y,Z) THAT DEFINES THE GEOMETRY OF THE VORTEX FILAMENT B-D.
C(FLAP)	GEOMETRY	L	CHORD LENGTH OF FLAP AND/OR AILERONS.

<sup>†</sup>Blank entries denote dimensionless quantities.

5.5 ALPHABETICAL LIST OF OUTPUT QUANTITIES (CONTINUED)

VARIABLE	COMMENT	UNITS	DEFINITION
C(TAB)	GEOMETRY	L	CHORD LENGTH OF TAB OR AUXILIARY FLAP SURFACE,
C(WING)	GEOMETRY	L	CHORD LENGTH OF LIFTING SURFACE CHORD-PLANE,
CG	INTG.COEFF.		CENTER OF GRAVITY LOCATION DEFINED BY REFERENCE DIMENSIONS,
CHORD C(CG)	GEOMETRY	L	REFERENCE CHORD LENGTH USED FOR NORMALIZING THE C.G. AERODYNAMIC COEFFICIENTS,
CMP SLOPE	ISURF		WING PITCHING MOMENT COEFFICIENT SLOPE, I.E., = D(WCMP)/D(ALFA).
CMR SLOPE	ISURF		WING ROLLING MOMENT COEFFICIENT SLOPE, I.E., = D(WCMR)/D(ALFA).
CMY SLOPE	ISURF		WING YAWING MOMENT COEFFICIENT SLOPE, I.E., = D(WCMY)/D(ALFA).
CPN	ND.GE,2		NORMAL FORCE PRESSURE COEFFICIENT FOR AN ELEMENTAL SURFACE,
D(X)	ND.GE,5	L	X-COORDINATE OF POINT D(X,Y,Z) THAT DEFINES THE GEOMETRY OF THE VORTEX FILAMENT B-D,
D(Y)	ND.GE,5	L	X-COORDINATE OF POINT D(X,Y,Z) THAT DEFINES THE GEOMETRY OF THE VORTEX FILAMENT B-D,
D(Z)	ND.GE,5	L	X-COORDINATE OF POINT D(X,Y,Z) THAT DEFINES THE GEOMETRY OF THE VORTEX FILAMENT B-D,
DC	ND.GE,1	L	CHORD INCREMENT OF A VORTEX-LATTICE ELEMENTAL SURFACE.
*DETERMINANT	INTG.COEFF.		VALUE OF DETERMINANT IN VORTEX-LATTICE MATRIX INVERSION,
DIHED(MGC/4)	GEOMETRY	DEG.	DIHEDRAL ANGLE BASED ON THE 1/4-CHORD LOCATION OF THE MEAN GEOMETRIC CHORD AND ROOT CHORD SPAN STATIONS,
DS	ND.GE,1	L**2	TRUE AREA INCREMENT OF A VORTEX-LATTICE ELEMENTAL SURFACE.
DWL	ND.GE,1	L	TRUE SPAN DIMENSION OF A VORTEX-LATTICE ELEMENTAL SURFACE.
E	INTG.COEFF.		DESIGNATION OF ELEMENTAL SURFACE (NTH SURFACE).
EB	INTG.COEFF.	L	SPAN OF ELEMENTAL SURFACE.
ECD	INTG.COEFF.		INDUCED DRAG COEFFICIENT FOR ELEMENTAL SURFACE,
ECL	INTG.COEFF.		LIFT COEFFICIENT FOR ELEMENTAL SURFACE,
ECMP	INTG.COEFF.		PITCHING MOMENT COEFFICIENT FOR ELEMENTAL SURFACE.
ECMR	INTG.COEFF.		ROLLING MOMENT COEFFICIENT FOR ELEMENTAL SURFACE.
ECMY	INTG.COEFF.		YAWING MOMENT COEFFICIENT FOR ELEMENTAL SURFACE

5.5 ALPHABETICAL LIST OF OUTPUT QUANTITIES (CONTINUED)

VARIABLE	COMMENT	UNITS	DEFINITION
ECN	INTG.COEFF.		NORMAL FORCE COEFFICIENT FOR ELEMENTAL SURFACE.
ECX	INTG.COEFF.		HORIZONTAL FORCE COEFFICIENT FOR ELEMENTAL SURFACE.
ECY	INTG.COEFF.		SIDE FORCE COEFFICIENT FOR ELEMENTAL SURFACE.
ELAPSED TIME	COMMENT		TIME ELAPSED SINCE START OF EXECUTION.
EMGC	INTG.COEFF.	L	MEAN GEOMETRIC CHORD OF ELEMENTAL SURFACE.
ES	INTG.COEFF.	L**2	AREA OF ELEMENTAL SURFACE.
EW	ND.GE,1	L	TRUE SPAN COORDINATE MEASURED AT POINT B OF AN ELEMENTAL SURFACE VORTEX FILAMENT.
EXA	INTG.COEFF.	L	LONGITUDINAL STATION FOR 1/4-CHORD POINT LOCATION OF ELEMENTAL SURFACE MEAN GEOMETRIC CHORD.
EZA	INTG.COEFF.	L	WATERLINE STATION FOR 1/4-CHORD POINT LOCATION OF ELEMENTAL SURFACE MEAN GEOMETRIC CHORD.
FCH	ISURF		HINGE MOMENT SECTION COEFFICIENT FOR FLAP OR AILERON CONTROL SURFACES.
FCN	ISURF		NORMAL FORCE SECTION COEFFICIENT FOR FLAP OR AILERON CONTROL SURFACES.
FCX	ISURF		CHORDWISE FORCE SECTION COEFFICIENT FOR FLAP OR AILERON CONTROL SURFACES.
FLAP DEFLEC	GEOMETRY	DEG.	FLAP DEFLECTION, I.E., + = DOWN,
FLAP SPAN1	GEOMETRY	L OR L/B	SPAN LOCATION OF THE INNER EDGE OF THE FLAP,
FLAP SPAN2	GEOMETRY	L OR L/B	SPAN LOCATION OF THE OUTER EDGE OF THE FLAP OR INNER EDGE OF THE AILERON.
FLAP SPAN3	GEOMETRY	L OR L/B	SPAN LOCATION OF THE OUTER EDGE OF THE AILERON,
FUS STA X(CG)	GEOMETRY	L	LONGITUDINAL STATION (X-COORDINATE) FOR THE LOCATION OF THE CENTER OF GRAVITY.
GAMA	ND.GE,2		STRENGTH OR CONCENTRATED VORTICITY FOR THE VORTEX FILAMENT OF AN ELEMENTAL SURFACE DEFINED BY THE POINTS B(X,Y,Z) AND D(X,Y,Z),
G(X)	ND.GE,2		X-COMPONENT OF THE UNIT VECTOR THAT DEFINES THE LINE OF ACTION OF THE LIFT FORCE ACTING ON AN ELEMENTAL SURFACE,
G(Y)	ND.GE,2		Y-COMPONENT OF THE UNIT VECTOR THAT DEFINES THE LINE OF ACTION OF THE LIFT FORCE ACTING ON AN ELEMENTAL SURFACE,
G(Z)	ND.GE,2		Z-COMPONENT OF THE UNIT VECTOR THAT DEFINES THE LINE OF ACTION OF THE LIFT FORCE ACTING ON AN ELEMENTAL SURFACE,
J			SPAN ARGUMENT OR INDEX,
JOB TIME	COMMENT		TIME ELAPSED FOR EXECUTION OF LAST JOB,

5.5 ALPHABETICAL LIST OF OUTPUT QUANTITIES (CONTINUED)

VARIABLE	COMMENT	UNITS	DEFINITION
K			CHORD ARGUMENT OR INDEX,
L/D	ISURF		LIFT TO DRAG RATIO,
L.AIL DEFLEC	GEOMETRY	DEG.	LEFT AILERON DEFLECTION, I.E., + = DOWN, AND, - = UP,
MACHN			MACH NUMBER OF THE FREE STREAM VELOCITY.
MEAN CHØRD	GEOMETRY	L	MEAN CHORD OF LIFTING SURFACE, I.E., EQUAL TO AREA/SPAN
MGC (MAC)	GEOMETRY	L	MEAN GEOMETRIC CHORD THAT IS DEFINED EQUAL TO THE MEAN AERODYNAMIC CHORD,
ND	OUTPUT		VALUE ASSIGNED TO NFLG(20) OR IPLG(10),
NG	ND.GE,5		SECOND ARGUMENT OR INDEX OF VORTEX-LATTICE INFLUENCE COEFFICIENT MATRIX,
NØ.CHØRD DISCØN.	GEOMETRY		NUMBER OF CHORD DISCONTINUITIES FOR THE LIFTING SURFACE VORTEX-LATTICE REPRESENTATION,
NØ.CHØRD ELEMENTS	GEOMETRY		NUMBER OF CHORD ELEMENTS FOR THE LIFTING-SURFACE VORTEX-LATTICE REPRESENTATION,
NØ.PLØT FILES	COMMENT		NUMBER OF FILES OUTPUT ON UNIT KT2 THAT ARE USED IN THE PROGRAM PLOTTING OPTION,
NØ.SPAN ELEMENTS	GEOMETRY		NUMBER OF SPAN ELEMENTS FOR THE LIFTING-SURFACE VORTEX-LATTICE REPRESENTATION,
NP	ND.GE,5		FIRST ARGUMENT OR INDEX OF VORTEX-LATTICE INFLUENCE COEFFICIENT MATRIX,
P(X)	ND.GE,2	L	X-COORDINATE OF A FIELD POINT ABOUT WHICH THE INDUCED VELOCITY IS CALCULATED,
P(Y)	ND.GE,2	L	Y-COORDINATE OF A FIELD POINT ABOUT WHICH THE INDUCED VELOCITY IS CALCULATED,
P(Z)	ND.GE,2	L	Z-COORDINATE OF A FIELD POINT ABOUT WHICH THE INDUCED VELOCITY IS CALCULATED,
RØØT CHØRD	GEOMETRY	L	CHORD LENGTH OF THE ROOT STATION,
RØØT TWIST	GEOMETRY	DEG.	GEOMETRIC TWIST OF CHORD PLANE AT THE ROOT, STATION (WASHIN), WHERE, + = LEADING EDGE UP, AND - = LEADING EDGE DOWN,
R.AIL DEFLEC	GEOMETRY	DEG.	RIGHT AILERON DEFLECTION, I.E., + = DOWN, AND, - = UP,
*SCALE	INTG.COEFF.		AVERAGE VALUE OF ELEMENTS IN THE VORTEX-LATTICE MATRIX
SCD	SECT.COEFF.		SECTION DRAG COEFFICIENT,
SCDI	ISURF		SECTION COEFFICIENT FOR INDUCED DRAG,
SCL	SECT.COEFF.		SECTION LIFT COEFFICIENT,
SCLA1	ISURF		ADDITIONAL LIFT DISTRIBUTION SECTION LIFT COEFFICIENT,

5.5 ALPHABETICAL LIST OF OUTPUT QUANTITIES (CONTINUED)

VARIABLE	COMMENT	UNITS	DEFINITION
SCLB	ISURF		BASIC LIFT DISTRIBUTION (WCL=0,0) SECTION LIFT COEFFICIENT.
SCLC/B	SECT.COEFF.		SECTION SPAN LOADING COEFFICIENT, I.E., SCL*(C/B).
SCN	SECT.COEFF.		SECTION NORMAL AIRLOAD COEFFICIENT, I.E., ACTING IN THE -Z DIRECTION.
SCX	SECT.COEFF.		SECTION CHORDWISE AIRLOAD COEFFICIENT, I.E., ACTING IN THE +X DIRECTION.
SMP C/4	SECT.COEFF.		SECTION PITCHING-MOMENT COEFFICIENT ABOUT THE LOCAL 1/4-CHORD LOCATION.
SPAN	GEOMETRY	L	SPAN OF LIFTING SURFACE.
SPAN B(CG)	GEOMETRY	L	REFERENCE SPAN LENGTH USED FOR NORMALIZING THE C.G. AERODYNAMIC COEFFICIENTS.
SWEEP(MGC/4)	GEOMETRY	DEG.	SWEEPBACK ANGLE BASED ON THE 1/4-CHORD LOCATION OF THE MEAN GEOMETRIC CHORD AND ROOT CHORD SPAN STATIONS.
TAB DEFLEC	GEOMETRY	DEG.	TAB DEFLECTION, I.E., + = DOWN, AND, - = UP.
TIP CHORD	GEOMETRY	L	CHORD LENGTH OF THE TIP STATION.
TIP TWIST	GEOMETRY	DEG.	GEOMETRIC TWIST OF CHORD PLANE AT THE TIP STATION (WASHOUT), WHERE, + = LEADING EDGE UP, AND - = LEADING EDGE DOWN,
TWIST	GEOMETRY	DEG.	GEOMETRIC TWIST OF THE CHORD PLANE, WHERE, + = LEADING EDGE UP, AND, - = LEADING EDGE DOWN.
VFS(MAT)	ND.GE,5	V/UFS	FREE STREAM VECTOR VELOCITY COMPONENT NORMAL TO THE ELEMENTAL SURFACE AT THE COLOCATION POINT P(X,Y,Z),
VIN(MAT)	ND.GE,5	V/UFS	INDUCED VELOCITY VECTOR COMPONENT NORMAL TO THE ELEMENTAL SURFACE AT THE COLOCATION POINT P(X,Y,Z) DUE TO THE VORTEX FILAMENT DEFINED BY B(X,Y,Z) AND D(X,Y,Z) POINTS.
VI(X)	ND.GE,2	V/UFS	X-COMPONENT OF THE VELOCITY VECTOR INDUCED BY THE SUM OF ALL ELEMENTAL SURFACE VORTEX FILAMENTS,
VI(Y)	ND.GE,2	V/UFS	Y-COMPONENT OF THE VELOCITY VECTOR INDUCED BY THE SUM OF ALL ELEMENTAL SURFACE VORTEX FILAMENTS.
VI(Z)	ND.GE,2	V/UFS	Z-COMPONENT OF THE VELOCITY VECTOR INDUCED BY THE SUM OF ALL ELEMENTAL SURFACE VORTEX FILAMENTS.
W	SECT.COEFF.	L	CUMULATIVE WETTED-SPAN DIMENSION IN CORE.
WCDI	ISURF		WING INDUCED DRAG COEFFICIENT,
WCL	ISURF		WING LIFT COEFFICIENT,
WCL SLOPE	ISURF		WING LIFT SLOPE, I.E., WCL/(ALFA-ALFAR)

5.5 ALPHABETICAL LIST OF OUTPUT QUANTITIES (CONTINUED)

VARIABLE	COMMENT	UNITS	DEFINITION
WCMP	ISURF		WING PITCHING MOMENT COEFFICIENT ABOUT 1/4 MAC. (MAC= MEAN AERODYNAMIC CHORD)
WCMR	ISURF		WING ROLLING MOMENT COEFFICIENT,
WCMY	ISURF		WING YAWING MOMENT COEFFICIENT,
WING STA Y(CG)	GEOMETRY	L	SPAN STATION (Y-COORDINATE) FOR THE LOCATION OF THE CENTER OF GRAVITY,
WL	ND.GE,1	L	SPAN COORDINATE IN-CORE FOR POINT B OF AN ELEMENTAL SURFACE VORTEX FILAMENT,
WL STA Z(CG)	GEOMETRY		VERTICAL WATER-LINE STATION (Z-COORDINATE) FOR THE LOCATION OF THE CENTER OF GRAVITY,
WS	GEOMETRY	L	WETTED-LENGTH SPAN STATION,
X		L	X-COORDINATE DEFINED FOR A RIGHT-HAND LOFT COORDINATE SYSTEM,
XA(N)/C	CAMBER	L/C	CHORD STATION NORMALIZED BY CHORD LENGTH FOR THE NTH LOCATION, N=1,2,3,....,10.
XBAR	GEOMETRY	L	LONGITUDINAL COORDINATE FOR THE 1/4-CHORD LOCATION OF THE MEAN GEOMETRIC CHORD,
X(C/4)	GEOMETRY	L	LONGITUDINAL STATION (X-COORDINATE) OF THE 1/4-CHORD LOCATION OF THE CHORD PLANE,
X(LE)	GEOMETRY	L	LONGITUDINAL STATION (X-COORDINATE) OF THE LEADING EDGE OF THE CHORD PLANE,
XN	ND.GE,1	L	X-COORDINATE OF THE COLOCATION POINT OF AN ELEMENTAL SURFACE,
X(TE)	GEOMETRY	L	LONGITUDINAL STATION (X-COORDINATE) OF THE TRAILING EDGE OF THE CHORD PLANE,
XV	ND.GE,1	L	X-COORDINATE OF POINT B OF AN ELEMENTAL SURFACE VORTEX FILAMENT,
Y		L	Y-COORDINATE DEFINED FOR A RIGHT-HAND LOFT COORDINATE SYSTEM,
Y*	SECT.COEFF,		DIMENSIONLESS SPAN COORDINATE, I.E., Y/SPAN,
YBAR	GEOMETRY	L	SPAN COORDINATE FOR THE 1/4-CHORD LOCATION OF THE MEAN GEOMETRIC CHORD,
YN	ND.GE,1	L	Y-COORDINATE OF THE COLOCATION POINT OF AN ELEMENTAL SURFACE,
YY	ND.GE,1	L	Y-COORDINATE OF POINT B OF AN ELEMENTAL SURFACE VORTEX FILAMENT
Z		L	Z-COORDINATE DEFINED FOR A RIGHT-HAND LOFT COORDINATE SYSTEM,
ZA(N)/C	CAMBER	L/C	VERTICAL LOCATION OF MEAN-CAMBER PLANE RELATIVE TO THE CHORD PLANE AND NORMALIZED BY THE CHORD,
ZBAR	GEOMETRY	L	VERTICAL COORDINATE FOR THE 1/4-CHORD LOCATION OF THE MEAN GEOMETRIC CHORD,

5.5 ALPHABETICAL LIST OF OUTPUT QUANTITIES (CONTINUED)

VARIABLE	COMMENT	UNITS	DEFINITION
ZN	ND.GE,1	L	Z-COORDINATE OF THE COLOCATION POINT OF AN ELEMENTAL SURFACE.
ZV	ND.GE,1	L	Z-COORDINATE OF POINT B OF AN ELEMENTAL SURFACE VORTEX FILAMENT
1XL	SECT,COEFF,		UNIT VECTOR IN THE +X DIRECTION FOR SECTION AIRLOAD.
1XN	ND.GE,1		X-COMPONENT OF THE NORMAL-UNIT-VECTOR AT THE COLOCATION POINT OF AN ELEMENTAL SURFACE.
1XV	ND.GE,1		X-COMPONENT OF THE UNIT VECTOR THAT DEFINES THE SPANWISE ORIENTATION OF THE VORTEX FILAMENT OF AN ELEMENTAL SURFACE.
1YL	SECT,COEFF,		UNIT VECTOR IN THE +Y DIRECTION FOR SECTION AIRLOAD.
1YN	ND.GE,1		Y-COMPONENT OF THE NORMAL-UNIT-VECTOR AT THE COLOCATION POINT OF AN ELEMENTAL SURFACE.
1YV	ND.GE,1		Y-COMPONENT OF THE UNIT VECTOR THAT DEFINES THE SPANWISE ORIENTATION OF THE VORTEX FILAMENT OF AN ELEMENTAL SURFACE.
1ZL	SECT,COEFF,		UNIT VECTOR IN THE +Z DIRECTION FOR SECTION AIRLOAD.
1ZN	ND.GE,1		Z-COMPONENT OF THE NORMAL-UNIT-VECTOR AT THE COLOCATION POINT OF AN ELEMENTAL SURFACE.
1ZV	ND.GE,1		Z-COMPONENT OF THE UNIT VECTOR THAT DEFINES THE SPANWISE ORIENTATION OF THE VORTEX FILAMENT OF AN ELEMENTAL SURFACE.

\* PROGRAM-CHECKOUT OUTPUT - NAMELIST DBUGV1, DBUGV2, DBUGV3, OR REFLEX \*

VARIABLE	COMMENT	UNITS	DEFINITION
ALFAR	ND.GT,15	RAD.	ANGLE OF ATTACK.
B	ND.GE,5	L	X-Y-Z COORDINATES OF POINT B(X,Y,Z) THAT DEFINES THE LOCATION OF THE ELEMENTAL VORTEX FILAMENT B-D.
COSR	ND.GT,15		COSINE(ALFAR).
D	ND.GE,5	L	X-Y-Z COORDINATES OF POINT D(X,Y,Z) THAT DEFINES THE LOCATION OF THE ELEMENTAL VORTEX FILAMENT B-D.
GAMA	ND.GE,5		STRENGTH OR CONCENTRATED VORTICITY OF THE VORTEX FILAMENT B-D.
P	ND.GE,5	L	X-Y-Z COORDINATES OF THE FIELD POINT P(X,Y,Z).
PHI	ND.GT,15	RAD.	ROTATION ANGLE.

5.5 ALPHABETICAL LIST OF OUTPUT QUANTITIES (CONTINUED)

VARIABLE	COMMENT	UNITS	DEFINITION
PSIF	ND.GE,5		INFLUENCE FUNCTION PSI,
PX	ND.GT,15	L	X-COORDINATE,
PY	ND.GT,15	L	Y-COORDINATE,
RX	ND.GT,15	L	X-COORDINATE FOR IMAGE POINT,
RY	ND.GT,15	L	Y-COORDINATE FOR IMAGE POINT,
TANA	ND.GE,5		TANGENT OF ALPHA,
VCØS	ND.GE,5		X-Y-Z COMPONENTS OF THE INDUCED VELOCITY VECTOR AT POINT P(X,Y,Z) DUE TO THE VORTEX FILAMENT B=D,
X1	ND.GT,15	L	X-COORDINATE FOR INTERMEDIATE POINT,
Y1	ND.GT,15	L	Y-COORDINATE FOR INTERMEDIATE POINT,
ZL	ND.GT,15	L	ALTITUDE,

5.6 LIST OF ABBREVIATIONS FOR OUTPUT

---

ALFA	ANGLE OF ATTACK
AIL	AILERON
ASSIG.	ASSIGNMENT
CAMBER	AIRFOIL SECTION MEAN CAMBER SPECIFICATIONS
CL	LIFT COEFFICIENT
CØNS.	CONSTANT
C,G.	CENTER OF GRAVITY
DEG.	ANGLE MEASURED IN DEGREES
DIM.	DIMENSION
:EQ.	EQUAL
E,G.	FOR EXAMPLE
GEOMETRY	LIFTING SURFACE GEOMETRY SPECIFICATIONS
.GE.	GREATER OR EQUAL
.GT.	GREATER THAN
INTG.CØEFF.	SPATIALLY-INTEGRATED COEFFICIENTS
I,E.	EQUIVALENT TO

## 5.6 LIST OF ABBREVIATIONS FOR OUTPUT (CONTINUED)

L	LINEAR DIMENSION
.LE.	LESS OR EQUAL
.LT.	LESS THAN
L/B	LINEAR DIMENSION NORMALIZED BY THE SPAN
L/C	LINEAR DIMENSION NORMALIZED BY THE CHORD
L**2	AREA UNITS, I.E., LINEAR UNITS SQUARED
ND,GE,1	NFLAG(20) OR IFLAG(10) GREATER OR EQUAL TO 1
ND,GE,2	NFLAG(20) OR IFLAG(10) GREATER OR EQUAL TO 2
ND,GE,5	NFLAG(20) OR IFLAG(10) GREATER OR EQUAL TO 5
ND,GT,15	NFLAG(20) OR IFLAG(10) GREATER THAN 15
OPT.	OPTIONAL
RAD.	ANGLE MEASURED IN RADIANS
REF	REFERENCE
SECT,Coeff.	AIRLOAD SECTION COEFFICIENTS
SURF.	SURFACE
V/UFS	VELOCITY NORMALIZED BY THE FREE STREAM VELOCITY
*	MULTIPLICATION
**	EXPONENTIATION

## 6.0 EXAMPLE PROBLEMS

### 6.1 INPUT-DATA LISTINGS

EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION  
\*\*\*\*\*

```
VZ RUN T54589.TRW,1001.3303A,1001,C,B,1           GOMEZ    TRW
  PLT
  PN MSG     FILE REG. TAPE 1 FH432 3 FSTRN 1
  ASG X=AIC202
  ASG F
  XGT CUR
  TRW X
  ERS
  FEF X
  IN X
  TRI X
  XGT NSURF
EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION
TASK 702, PROJECT 3303A, MJO 14703, AERODYNAMIC ANALYSIS AND DESIGN
SUBSONIC FLOW LIFTING SURFACE ANALYSIS, TRW PROGRAM NO. HA010B (NSURE)
A.V.GOMEZ/ 5 JULY 1972

$INPUT
NWING=2, NFUS=1, NVTAIL=-2,
MWING=1,
NSS(1)=3, NCS(1)=2, NFLG(1)=28, NFLG(6)=4, NFLG(11)=1,
X(1)=3*30., Y(1)=0., Z(1)=2*0., -17, 633, E(1)=2*4., -1., XCGR(1)=3*1.,
C(1)=2*40., 10., XC(1,1)=0., 1., FLAPC(1)=3*0.30, TABC(1)=3*0.08,
FLAPD(1)= 40., ALDU(1,1)=20., 15., WFLAP1(1)=0., WFLAP2(1)=40., WFLAP3(1)=140.,
MNTAIL=1,
NSS(2)=5, NCS(2)=2, NFLG(2)=8, NFLG(7)=3, NFLG(12)=1,
X(4)=2*150., Y(4)=0., 40., Z(4)=2*20., -2*2., E(4)=2*2., XCGR(4)=2*1., C(4)=30., 20.,
XC(1,2)=0., 1., FLAPC(4)=2*10., TABC(4)=2*3.,
FLAPD(2)=30.,
WFLAP1(2)=0., WFLAP2(2)=40., WFLAP3(2)=40.,
MFUSEL=1,
NSS(3)=7, NCS(3)=2, NFLG(3)=2, NFLG(8)=4,
X(6)=2*50., Y(6)=2*0., Z(6)=0., -20., E(6)=2*0., XCGR(6)=2*0., C(6)=80., 200.,
XC(1,3)=0., 1.,
MVTAIL=1,
NSS(4)=9, NCS(4)=2, NFLG(4)=3, NFLG(9)=4, NFLG(14)=1,
X(8)=2*150., Y(8)=2*40., Z(8)=10., 40., E(8)=2*0., XCGR(8)=2*1.,
C(8)=2*5., 10., XC(1,4)=0., 1., FLAPC(8)=2*0.5, TABC(8)=2*0.10,
FLAPD(4)= 30.,
WFLAP1(4)=0., WFLAP2(4)=30., WFLAP3(4)=30.,
NACELLE=1,
NSS(5)=12, NCS(5)=2, NFLG(5)=2, NFLG(10)=6,
X(10)=3*30., Y(10)=3*40., Z(10)=10., 0., -10., E(10)=3*0., XCGR(10)=3*0.,
C(10)=30., 2*40., XC(1,5)=0., 1.,
XCG=0.0, REPC=32.881, REFB=280.0, REFS=8200.0,
KT2=8, NFLG(19)=1, NUDB1, ALFA=10., MACHN=0., NSOLV=12=0,
SEND
EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION
$INPUT
NWING=2, NFUS=0, NVTAIL=0, NFLG(19)=0, NSOLV=1, 1, 2, FLAPD= 30., -10.,
NFLG(1)=14, 4,
SEND
SENDJOB8
  XGT TRWPLT
  KUNIT = 8
  ICCOMP= 0
  NTRAN = 0
  IPRINT= 0
  MTYPE = 0
  NDFSL= 1
  ISCALY = 1.1,1+1.1,1.1,1.1
  NXL = 24
  NXR = 24
  NYL = 24
  NYH = 24
  NPOSN1 = 600, 950
  NPOSN2 = 600, 925
  NPOSN3 = 600, 900
  NPOSN4 = 600, 50
  ANNOT1 = ID = EXAMPLE PROB. 1 - MULTIPLE-SURFACE
  ANNOT2 = ID = CAPABILITY DEMONSTRATION RUN
  ANNOT3 = ID = A.GOMEZ/ 5 JULY 72
  ANNOT4 = ID =
  CHARS2 = 1.0,1.0,1.0,1.0
  TITLE = ID = ISOMETRIC PROJECTION OF LIFTING SURFACES
  XLABEL = ID = HORIZONTAL AXIS, SEMISPANS
  YLABEL = ID = VERTICAL AXIS SEMISPANS
  XMI= 1.5
  XLD= 1.0
  YHI= 1.5
  YLO= -1.0
  PLOT = 2,1, 3,1, ENDLIST
ENDPLT
  ANOTSV = 0
  NOADV = 1
  PLDT = 5,1, 6,1, ENDLIST
ENDPLT
  NOADV = 1
  PLOT = 2,2, 3,2, ENDLIST
ENDPLT
  NOADV = 1
  PLOT = 2,3, 3,3, ENDLIST
ENDPLT
ENDPLT
  NOADV = 1
  PLOT = 2,1, 3,1, ENDLIST
ENDPLT
  NOADV = 1
  PLOT = 5,1, 6,1, ENDLIST
ENDPLT
```

39 PUNCHED-CARDS INPUT DECK  
REQUIRED FOR XGT NSURF

120 PUNCHED-CARDS INPUT DECK  
REQUIRED FOR XGT TRWPLT  
(PLOT-OPTION)

ORIGINAL PAGE IS  
OF POOR QUALITY

GENERAL NOTES: 1. V = 7/8 PUNCH

2. COMMENTS ARE PRINTED IN "ITALIC TYPE"

3. DASHED-LINES INDICATE THE START OF A NEW OUTPUT PAGE (-----)

4. BROKEN-SOLID-LINES INDICATES OUTPUT HAS BEEN EDITED ( ----- )

#### 6.1 INPUT-DATA LISTINGS (CONTINUED)

```
NOADV = 1
PLOT = 2,2, 3,2, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
NOADV = 1
PLOT = 2,1, 3,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 5,1, 6,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,2, 3,2, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
NOADV = 1
PLOT = 2,1, 3,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 5,1, 6,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,2, 3,2, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
NOADV = 1
PLOT = 2,1, 3,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 5,1, 6,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,2, 3,2, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
NOADV = 1
PLOT = 2,1, 3,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 5,1, 6,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,2, 3,2, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
ENDRUN
%EOF
```

## 6.1 INPUT-DATA LISTINGS (CONTINUED)

### EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION

```

VZ RUN T54589,TRW,1002,3303A,1002,C,5,1           GOMEZ    TRW
VN MSG      FILE REG. TAPE 1 FM432 3 FSTRN 1
V ASC X=10202
V ABC F
V PLT
V XQT CUR
TRW X
EPS
PFF X
IM X
V XQT ISURF
EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION
TASK 702, PROJECT 3303A, MJO 147033, AERODYNAMIC ANALYSIS AND DESIGN
SUBSONIC-FLOW LIFTING SURFACE ANALYSIS, TRW PROGRAM NO. HAD10B (NSURF)
A.V.GOMEZ/ 5 JULY 1972

$INPUT
NSS=2, NC5=2, IFLG(2)=0.16,0, [IFLG(3)=1.4,0, [IFLG(10)=5,
X=2*0,0; Y=0,0,30,0; Z=2*0,0; E=2*0,0, C=15,0,5,0, XC0=0,0,25, XOC=0,0,1,0,
WFLAP1=0,, WFLAP2=0,625, WFLAP3=1,0, FLAPC=0,25, WSHDTHM=0,25,
PNECF=1, LDRAE=1, CLEANP=0,0035, NJOB=1, MACHN=0,2, ALFA0=0, DELALF=-12,
FLAPDJ=30,0, 4ILDJ=10,0,-15,0,
KTZ=8, [IFLG(11)=441,
NJUBL=9, WCL=1, 0.,0.25,0.5,0.75,1,0.1,25,1,5,1,75,2,0,
$END

V XQT TRWPLT
KUNIT = 0
ICCOMP = 0
NTRAN = 0
IPRINT = 0
NTYPE = 0
NOFSCL = 1
ISCALY = 1,1,1,1,1,1,1,1,1,1,1,1
NXL = 24
NXR = 24
NYL = 24
NYH = 24
NPOSN1 = 600, 950
NPOSN2 = 600, 925
NPOSN3 = 600, 900
NPOSN4 = 600, 50
CHARSZ = 1,0, 1,0, 1,0, 1,0
ANNOT1 = 10 = EXAMPLE PROB, 2 - SINGLE-SURFACE
ANNOT2 = 10 = CAPABILITY DEMONSTRATION RUN
ANNOT3 = 10 = A,GOMEZ/ 5 JULY 72
ANNOT4 = 10 =
TITLE = 10 = LIFTING SURFACE PLANFORM GEOMETRY
XLABEL = 10 = HORIZONTAL AXIS, SEMISPANS
YLABEL = 10 = VERTICAL AXIS SEMISPANS
XLO = -1,1
XHI = 1,1
YLO = -.5
YHI = 1,7
PLOT = 1,1, 2,1, 4,1, ENDLST
ENDPLT
ANOTSV = 0
NOADV = 1
PLOT = 1,2, 2,2, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,3, 2,3, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,4, 2,4, 3,4, ENDLST
ENDPLT
TITLE = 10 = ISOMETRIC PROJECTION OF WING PLANFORM
YLO = -1,1
YHI = 1,1
PLOT = 1,5, 2,5, ENDLST
ENDPLT
NOADV = 1
PLOT = 3,5, 4,5, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,6, 2,6, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,7, 2,7, ENDLST
ENDPLT
PLOT = 5,5, 2,5, ENDLST
ENDPLT
NOADV = 1
PLOT = 6,5, 4,5, ENDLST
ENDPLT
NOADV = 1
PLOT = 3,6, 2,6, ENDLST
ENDPLT
NOADV = 1
PLOT = 3,7, 2,7, ENDLST
ENDPLT
ENDPLT
ANNOT1 = 10 = EXAMPLE PROB, 2 - SINGLE-SURFACE
ANNOT2 = 10 = CAPABILITY DEMONSTRATION RUN
ANNOT3 = 10 = A,GOMEZ/ 5 JULY 72
ANNOT4 = 10 =
CHARSZ = 1,0, 1,0, 1,0, 1,0
TITLE = 10 = CHORDWISE PRESSURE DISTRIBUTION (CPL-CPU)
XLABEL = 10 = HORIZONTAL DISTANCE, CHORDS
YLABEL = 10 = DIFFERENTIAL PRESSURE COEFFICIENT
XLO = 0,0
XHI = 3,2
YLO = -3,0
YHI = 9,0
CADD = 0,0, 0,0
PLOT = 1,1, 2,1, ENDLST
ENDPLT
NOADV = 1
CADD = 0,2, 0,9
PLOT = 1,2, 2,2, ENDLST
ENDPLT

```

14 PUNCHED-CARDS INPUT DECK  
REQUIRED FOR XQT ISURF

305 PUNCHED-CARDS INPUT DECK  
REQUIRED FOR XQT TRWPLT  
(13 FIGURES)

FIGURE # 1, PLANFORM VIEW OF WING

FIGURE # 2, ISOMETRIC PROJECTION OF WING

FIGURE # 3, CHORDWISE PRESSURE DISTRIBUTION

ORIGINAL PAGE IS  
OF POOR QUALITY

## 6.1 INPUT-DATA LISTINGS (CONTINUED)

```

NOADV = 1
CADD = 0.4, 1.0
PLOT = 1.4, 2.4, ENDPLT
ENDPLT
NOADV = 1
CADD = 0.6, 1.9
PLOT = 1.6, 2.6, ENDPLT
ENDPLT
NOADV = 1
CADD = 0.8, 2.0
PLOT = 1.8, 2.8, ENDPLT
ENDPLT
NOADV = 1
CADD = 1.0, 2.5
PLOT = 1.9, 2.9, ENDPLT
ENDPLT
NOADV = 1
CADD = 1.2, 3.0
PLOT = 1.11, 2.11, ENDPLT
ENDPLT
NOADV = 1
CADD = 1.4, 3.5
PLOT = 1.13, 2.13, ENDPLT
ENDPLT
NOADV = 1
CADD = 1.6, 4.0
PLOT = 1.15, 2.15, ENDPLT
ENDPLT
NOADV = 1
CADD = 1.8, 4.5
PLOT = 1.16, 2.16, ENDPLT
ENDPLT
ENDFILE
TITLE = 10 * SPAN AIRLOAD DISTRIBUTION
XLABEL = 10 * HORIZONTAL DISTANCE, SEMISPANS
YLABEL = 10 * SECTION LIFT COEFFICIENT CL
CADD = 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0
XLO = -1.2
XHI = 1.2
YHI = 3.0
YLO = -1.0
PLOT = 1.1, 2.1, ENDPLT
ENDPLT
YLABEL = 10 * SECTION INDUCED DRAG COEFFICIENT CDI
PLOT = 1.1, 3.1, ENDPLT
ENDPLT
YLABEL = 10 * SECTION PITCHING MOMENT COEFFICIENT CMAC
YLO = -1.5
YHI = 1.0
PLOT = 1.1, 4.1, ENDPLT
ENDPLT
ENDFILE
TITLE = 10 * LINEAR SOLUTION - SPAN AIRLOAD DISTRIBUTION
XLABEL = 10 * HORIZONTAL DISTANCE, SEMISPANS
YLABEL = 10 * SECTION LIFT COEFFICIENT CL
XLO = -1.2
XHI = 1.2
YHI = 3.0
YLO = -1.5
PLOT = 1.1, 2.1, ENDPLT
ENDPLT
NOADV = 1
PLOT = 1.2, 2.2, ENDPLT
ENDPLT
NOADV = 1
PLOT = 1.3, 2.3, ENDPLT
ENDPLT
NOADV = 1
PLOT = 1.4, 2.4, ENDPLT
ENDPLT
NOADV = 1
PLOT = 1.5, 2.5, ENDPLT
ENDPLT
NOADV = 1
PLOT = 1.6, 2.6, ENDPLT
ENDPLT
NOADV = 1
PLOT = 1.7, 2.7, ENDPLT
ENDPLT
NOADV = 1
PLOT = 1.8, 2.8, ENDPLT
ENDPLT
YLABEL = 10 * SECTION INDUCED DRAG COEFFICIENT CDI
PLOT = 1.1, 3.1, ENDPLT
ENDPLT
NOADV = 1
PLOT = 1.2, 3.2, ENDPLT
ENDPLT
NOADV = 1
PLOT = 1.3, 3.3, ENDPLT
ENDPLT
NOADV = 1
PLOT = 1.4, 3.4, ENDPLT
ENDPLT
NOADV = 1
PLOT = 1.5, 3.5, ENDPLT
ENDPLT
NOADV = 1
PLOT = 1.6, 3.6, ENDPLT
ENDPLT
NOADV = 1
PLOT = 1.7, 3.7, ENDPLT
ENDPLT
NOADV = 1
PLOT = 1.8, 3.8, ENDPLT
ENDPLT
YLABEL = 10 * SECTION PITCHING MOMENT COEFFICIENT CMAC
YLO = -1.5
YHI = 1.0
PLOT = 1.1, 4.1, ENDPLT
ENDPLT
NOADV = 1
PLOT = 1.2, 4.2, ENDPLT
ENDPLT

```

FIGURE # 4, SECTION LIFT COEFFICIENT

FIGURE # 5, SECTION INDUCED DRAG COEFFICIENT

FIGURE # 6, SECTION PITCHING MOMENT COEFFICIENT

FIGURE # 7, SECTION LIFT COEFFICIENT ARRAY  
(LINEAR SOLUTION)

FIGURE # 8, SECTION INDUCED DRAG COEFFICIENT ARRAY  
(LINEAR SOLUTION)

FIGURE # 9, SECTION PITCHING MOMENT COEFFICIENT ARRAY  
(LINEAR SOLUTION)

## 6.1 INPUT-DATA LISTINGS (CONTINUED)

```

NOADV = 1
PLOT = 1,3, 4,3, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,4, 4,4, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,5, 4,5, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,6, 4,6, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,7, 4,7, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,8, 4,8, ENDLST
ENDPLT
YLABEL= ID = FLAP/AIL NORMAL FORCE COEFF CNF
YLO = -2.0
YHI = 4.0
PLOT = 1,1, 5,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,2, 5,2, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,3, 5,3, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,4, 5,4, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,5, 5,5, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,6, 5,6, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,7, 5,7, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,8, 5,8, ENDLST
ENDPLT
YLABEL= ID = FLAP/AIL HORIZ FORCE COEFF CXF
PLOT = 1,1, 6,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,2, 6,2, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,3, 6,3, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,4, 6,4, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,5, 6,5, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,6, 6,6, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,7, 6,7, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,8, 6,8, ENDLST
ENDPLT
YLABEL= ID = FLAP/AIL HINGE MOMENT COEFF CHF
YLO = -1.5
YHI = 1.0
PLOT = 1,1, 7,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,2, 7,2, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,3, 7,3, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,4, 7,4, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,5, 7,5, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,6, 7,6, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,7, 7,7, ENDLST
ENDPLT
NOADV = 1
PLOT = 1,8, 7,8, ENDLST
ENDPLT
YLABEL = IO = WING AIRLOAD COEFFICIENTS
XLABEL = IO = WING ANGLE OF ATTACK, ALFA
XLO = -15.0
XHI = 25.0
YLO = -1.0
YHI = 3.0
PLOT = 1,9, 2,9, 3,9, 4,9, ENDLST
ENDPLT
ENDFIL
ENDRUN
VEOF

```

FIGURE # 10, FLAP NORMAL FORCE SECTION COEFFICIENT ARRAY  
(LINEAR SOLUTION)

FIGURE # 11, FLAP CHORD FORCE SECTION COEFFICIENT ARRAY  
(LINEAR SOLUTION)

FIGURE # 12, FLAP HINGE MOMENT SECTION COEFFICIENT ARRAY  
(LINEAR SOLUTION)

FIGURE # 13, WING AIRLOAD COEFFICIENTS  
(LINEAR SOLUTION)

## 6.1 INPUT-DATA LISTINGS (CONTINUED)

EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AERODYNAMIC ANALYSIS

```

VZ RUN T54BB9.TRW,1003,3303A,1003,C,5,1          GOMEZ TRW
VN MSG FILE REQ. TAPE 1 FH432 3 FSTRN 1
V ASG X=11202
V ASG F
V PLT
V XGT CUR
TRN X
ERS
PEF X
IN X
V XGT NSURF
EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AERODYNAMIC ANALYSIS
TASK 72, PROJECT 33D3A, MJD 147033, AERODYNAMIC ANALYSIS AND DESIGN
SUBSONIC-FLOW LIFTING SURFACE ANALYSIS, TRW PROGRAM NO. MAG10B (NSURF)
A.V.GOMEZ/ 5 JULY 1972

$INPUT
NWING=3,NVTAIL=-1, OSCALE=0.083333, COLOC=0.80,
MUNIG=1,
NNS(1)=7,NCN(1)=2,NFLG(1)=22,XOC(1,1)=0.0,1.0,
X(1)=-50.5,-50.5,-50.5,5.3*0.0, XCOCR(1)=7*1.0,
Y(1)=0.,57.27,114.54,171.81,229.08,400.89,629.97,
Z(1)=2*0.0,0.441.0,0.882.3*0.0,
E(1)=2*0.0,-0.5,-1.0,-1.5,-3.0,-3.0,
C(1)=1413.08,1261.514,1110.456,984.394,908.832,530.647,26.4,
MCANR01,
NS(2)=8,NCN(2)=3,NFLG(2)=6,NFLG(7)=2,XOC(1,2)=0.0,0.5,1.0,
X(8)=-1723.0,-1723.0, XCOCR(8)=0.55,0.31532,
Y(8)=0.0,-171.81,
Z(8)=-73.0,-73.0,
E(8)=2*3.0,
C(8)=249.5,96.71,
ZOC(1,8)=0.0,0.0,0.08816,
ZOC(1,9)=0.0,0.0,0.08816,
MFUS=1,
NNS(3)=11,NCN(3)=2,NFLG(3)=2,XOC(1,3)=0.0,1.0,
X(10)=-1463.08,-1312.018, Y(10)=0.,57.27, Z(10)=2*0.0,E(10)=2*0.0,
C(10)=740.0,640.0, XCOCR(10)=1.0,1.0,0.0,XOC(1,3)=0.,1.0,
MFUNS=1,
NNS(4)=13, NCN(4)=2, NFLG(4)=3, NFLG(9)=2, XOC(1,4)=0.0,1.0, XCOCR(12)=2*1.0,
X(12)=-50.5,30.0, Y(12)=2*171.81, Z(12)=0.882,-171.81, E(12)=1.0,-1.0,
C(12)=328.1313,83.07,
XCGR=725.9, ZCG=5.5,YCG=0.0, REFS=906883.0, REFC=942.38, REFB=1260.0,
NJDB=1, ALFA=10, MACHN=0.20, NSOLV=1.1,2,1,4,
KT2= 0, NFLG(19)= 1, 0,
$END
$ENDJOBS
V XGT TRWPLT
KUNIT = 8
ICCOMP= 0
NTRAN = 0
IPRINT= 0
NTYPE = 0
NOFSL= 1
ISCALY = 1.1*1.1,1.1,1.1,1.1,1.1,1.1
NXL = 24
NXR = 24
NYL = 24
NYH = 24
NPOSN1 = 600, 950
NPOSN2 = 600, 925
NPOSN3 = 600, 900
NPOSN4 = 600, 50
ANNOT1 = ID = EXAMPLE PROB. 3 - XB-70 AIRPLANE
ANNOT2 = ID = SUBSONIC AERODYNAMIC ANALYSIS
ANNOT3 = ID =
ANNOT4 = ID =
CHARSZ2 = 1,0,1.0,1.0,1.0
TITLE = ID = ISOMETRIC PROJECTION OF LIFTING SURFACES
XLABEL = ID = HORIZONTAL AXIS, SEMISPANS
YLABEL = ID = VERTICAL AXIS SEMISPANS
XHI= 2.0
XLO= -2.0
YHI= 2.0
YLO= -2.0
PLOT = 2,1, 3,1, ENDLST
ENDPLT
ANOTSV = 0
NOADV = 1
PLOT = 5,1, 6,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,2, 3,2, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
NOADV = 1
PLOT = 2,1, 3,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 5,1, 6,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,2, 3,2, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
NOADV = 1
PLOT = 2,1, 3,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 5,1, 6,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,2, 3,2, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
NOADV = 1
PLOT = 2,1, 3,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 5,1, 6,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,2, 3,2, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL

```

36 PUNCHED-CARDS INPUT DECK  
REQUIRED FOR XGT NSURF

108 PUNCHED-CARDS INPUT DECK  
REQUIRED FOR XGT TRWPLT  
(PLOT OPTION)

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OF POOR QUALITY

## 6.1 INPUT-DATA LISTINGS (CONTINUED)

```

NOADV = 1
PLOT = 2,3, 3,3, ENDLBT
ENDPLT
ENDFIL
NOADV = 1
PLOT = 2,1, 3,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 5,1, 6,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,2, 3,2, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
NOADV = 1
PLOT = 2,1, 3,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,2, 3,2, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
NOADV = 1
PLOT = 2,1, 3,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,2, 3,2, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
NOADV = 1
PLOT = 5,1, 6,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,2, 3,2, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
ENDRUN
VEOF

```

## EXAMPLE PROBLEM NO. 4 - THICK WING PHOBLEM AERODYNAMIC ANALYSIS

**35 PUNCHED-CARDS INPUT DECK  
REQUIRED FOR IQT NSURF**

(PLATE 60)

## 6.1 INPUT-DATA LISTINGS (CONTINUED)

```

NPOSN2 = 600, 925
NPOSN3 = 600, 900
NPOSN4 = 600, 50
CHARSZ = 1.0, 1.0, 1.0, 1.0
ANOT2 = ID * SUBSONIC AERODYNAMIC ANALYSIS
ANOT2 = ID * SUBSONIC AERODYNAMIC ANALYSIS
ANOT3 = ID *
ANOT4 = ID *
CHARSZ = 1.0*1.0,1.0,1.0
TITLE * ID * ISOMETRIC PROJECTION OF LIFTING SURFACES
XLABEL = ID * HORIZONTAL AXIS, SEMISPANS
YLABEL = ID * VERTICAL AXIS SEMISPANS
XLO = -1.0
XHI = 2.0
YLO = -1.0
YHI = 2.0
XLO=-2.0
XHI= 3.0
YLO=-2.0
YHI= 3.0
PLOT = 2,1, 3,1, ENDLST
ENDPLT
ANOTSV = 0
NOADV = 1
PLOT = 5,1, 6,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,2, 3,2, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
ENDPLT
NOADV = 1
PLOT = 2,1, 3,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 5,1, 6,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,2, 3,2, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
ENDRUN
7EOF

```

### EXAMPLE PROBLEM NO. 5 - DEBUG-PRINT OUTPUT OPTIONS DEMONSTRATION

```

VZ RUN T54589,TRW,1005,3303A,1005,C,1,1           GOMEZ    TRW
VN MSG     FILE REQ.   TAPE 1 FH432 3 FSTRV 0
V  ASG X#10202
V  XQT CUR
TRW X
ERS
IN X
TRI X
V  XQT NSURF
EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 0
TASK 702, PROJECT 3303A, MJO 147033, AERODYNAMIC ANALYSIS AND DESIGN
SUBSONIC-FLOW LIFTING SURFACE ANALYSIS, TRW PROGRAM NO. HAD10B (NSURF)
A.V.GOMEZ/ 5 JULY 1972
$INPUT
$INPUT
NCS(1)=2, NCS(2)=2, NFLG(1)=3, NFLG(6)=2, NFLG(11)=1,
X(1)=2*0., Y(1)=0., Z(1)=2*0., E(1)=2*0., C(1)=2*ID., XCRC(1)=2*0.25,
XC(1)=0.,1., FLAPDQ(1)= 10., NJOB=1, ALFA= 5, MACHN= 0., NSOLV=1,1,
NFLG(2)= 0,
SEND
EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 1
$INPUT
$INPUT
NFLG(20)= 1,
SEND
EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 2
$INPUT
$INPUT
NFLG(20)= 2,
SEND
EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 5
$INPUT
$INPUT
NFLG(20)= 5,
SEND
EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 8
$INPUT
$INPUT
NFLG(20)= 8,
SEND
EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 16
$INPUT
$INPUT
NFLG(20)= 16, NFLG(17)=1,
SEND
$ENDJOBS

V  XQT NSURFT
V  XQT ISURFT
VEOF

```

33 PUNCHED-CARDS INPUT DECK  
REQUIRED FOR XQT NSURF

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## 6.2 EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY

SUBSONIC-FLOW LIFTING SURFACE ANALYSIS PROGRAM HAO10B  
TRW SYSTEMS INC., HOUSTON OPERATIONS  
HOUSTON, TEXAS 77058

\*\*\*\*\* JOBS INPUT LIST \*\*\*\*\*

```

7 XUT NSURF
EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION
TASK 702, PROJECT 33034, MJD 147034, AERODYNAMIC ANALYSIS AND DESIGN
SUBSONIC-FLOW LIFTING SURFACE ANALYSIS, IWM PROGRAM NO. HAN10B (NSURF)
A.V.LUOMEZ/ 5 JULY 1972

$INPUT
NWING=2, NFUS=1, NVTAIL=-2,
MWING=1,
NS(1)=3, NCS(1)=2, NFLG(1)=28, NFLU(6)=4, NFLG(11)=1,
X(1)=3*30., Y(1)=0., 40., 140., Z(1)=z*u., -17.033, E(1)=2*4., -1., XOCR(1)=3*1.,
C(1)=2*40., 10., XC(1)=0., L., FLAPL(1)=2*0.30, TABC(1)=3*0.08,
FLAPD(1)=40., TAUD(1)=20., 15., WFLAP1(1)=0., WFLAP2(1)=40., WFLAP3(1)=140.,
MVTAIL=1,
NS(2)=5, NCS(2)=2, NFLG(2)=8, NFLG(7)=3, NFLG(12)= 1,
X(4)=2*150., Y(4)=0., 40., Z(4)=2*-z*u., L(4)=2*2*-2., XOCR(4)=2*1., C(4)=30., 20.,
XC(1,2)=0., 1., FLAPC(4)=2*10., TAUC(4)=2*2.,
FLAPD(2)=30., WFLAP1(2)=0., WFLAP2(2)=40., WFLAP3(2)=40.,
MFUSE=1,
NS(3)=7, NCS(3)=2, NFLG(3)=2, NFLU(6)=4,
X(6)=2*45., Y(6)=2*0., Z(6)=0., -20., E(6)=z*u., XOCR(6)=2*0., C(6)=80., 200.,
XC(1,3)=0., L.,
MVTAIL=1,
NS(4)=9, NCS(4)=2, NFLG(4)=3, NFLU(9)=4, NFLU(14)=1,
X(8)=2*150., Y(8)=2*40., Z(8)=-10., -40., E(8)=2*0., XOCR(8)=2*1.,
C(8)=2*5., 10., XC(1,5)=0., 1., FLAPL(8)=2*0., TABC(8)=2*0.10,
FLAPD(4)=30., WFLAP1(4)=0., WFLAP2(4)=30., WFLAP3(4)=30.,
NACEL=1,
NS(5)=12, NCS(5)=2, NFLG(5)=2, NFLU(11)=0.,
X(10)=3*30., Y(10)=3*40., Z(10)=10., 0., -10., E(10)=3*0., XOCR(10)=3*0.,
C(10)=30., 2*60., XC(1,5)=1., 0., 1.,
CG=0., REFCD=32.681, REFB=280.0, REFSD=8200.0,
KT2=8, NFLG(19)=1, NJOB=1, ALFA=10., MACHIN=0.2, NSOLV=12*0,
$END
EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION
$INPUT
NWING=2, NFUS=0, NVTAIL=0, NFLG(19)=0, NSOLV=1, 1, 1, 2, FLAPD= 30., -10.,
NFLG(1)=14., 4,
$END
$NOJOBS
7 XUT NSURF

```

DASHED LINE INDICATES NEW PAGE

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
 VALUE 28 8 2 3 2 4 3 4 4 6 1 1 0 1 0 0 0 1 1 4 ALFA= .00 MACHND= .0000 ALTITUDE=\*\*\*\*\* 1

```

$INPUT
KOUT = +6,
KT1 = +1,
KT2 = +8,
KT3 = +3,
LINK = +56,
NWINC = +2,
NVTAIL = -2,
NFUS = +1,
COLOCP = .7500000E+00,
CUTOF1 = .1000000E-03,
CUTOF2 = .2900000E-02,
LFLAAP = +0,
GSCALE = +1000000E+01,
NSS = +3, +3, +7, +9,
NCS = +12, +2, +2, +2, +2,
X = .3000000E+02, .3000000E+02, .3000000E+02,
-.1500000E+03, .1500000E+03, -.1500000E+02, -.5000000E+02,
-.1500000E+03, .1500000E+03, -.1500000E+02, -.3000000E+02,
-.3000000E+02, .0000000E+00, .0000000E+00, .0000000E+00,
.0000000E+00, .0000000E+00, .0000000E+00, .0000000E+00,
.0000000E+00, .0000000E+00, .0000000E+00, .0000000E+00,
.0000000E+00, .0000000E+00, .0000000E+00, .0000000E+00,
Y = .0000000E+00, -.4000000E+02, .1400000E+03,
.4000000E+00, .4000000E+02, .4000000E+02, .4000000E+02,
.4000000E+02, .4000000E+00, .4000000E+00, .4000000E+00,
.0000000E+00, .0000000E+00, .0000000E+00, .0000000E+00,
.0000000E+00, .0000000E+00, .0000000E+00, .0000000E+00,
.0000000E+00, .0000000E+00, .0000000E+00, .0000000E+00,
Z = .0000000E+00, .0000000E+00, -.1763300E+02,
-.2000000E+02, -.2000000E+02, .0000000E+00, -.2000000E+02,
-.1000000E+02, -.4000000E+02, .1000000E+02, .0000000E+00,
-.1000000E+02, .0000000E+00, .0000000E+00, .0000000E+00,
.0000000E+00, .0000000E+00, .0000000E+00, .0000000E+00,
.0000000E+00, .0000000E+00, .0000000E+00, .0000000E+00,
E = .4000000E+01, .4000000E+01, -.1000000E+01,
-.2000000E+01, -.2000000E+01, .0000000E+00, .0000000E+00,
.0000000E+00, .0000000E+00, .0000000E+00, .0100000E+00,
.0000000E+00, .0000000E+00, .0000000E+00, .0000000E+00,
.0000000E+00, .0000000E+00, .0000000E+00, .0000000E+00,
.0000000E+00, .0000000E+00, .0000000E+00, .0000000E+00,
C = .4000000E+02, .4000000E+02, .4000000E+02, .1000000E+02,
.3000000E+02, .2000000E+02, .0000000E+00, .2000000E+03,
.2500000E+02, .1000000E+02, .3000000E+02, .0000000E+00,
.6000000E+02, .0000000E+00, .0000000E+00, .0000000E+00,

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ORIGINAL PAGE IS  
OF POOR QUALITY

## 6.2 EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

```

    .0000000E+00,
    KOCR = -.1000000E+01, +1000000E+01, .1000000E+01,
    -.1000000E+01, .1000000E+01, -.1000000E+00, .1000000E+00,
    .1000000E+01, .1000000E+01, .1000000E+00, -.1000000E+00,
    .0000000E+00, .2500000E+00, -.2500000E+00, .2500000E+00,
    .2500000E+00, .2500000E+00, -.2500000E+00, .2500000E+00,
    .2500000E+00, .2500000E+00, -.2500000E+00, .2500000E+00,
    .2500000E+00, .2500000E+00, -.2500000E+00, .2500000E+00

```

**WFLAPI =** .<sup>-25000000E+00,</sup> .<sup>-25000000E+00,</sup> .<sup>-25000000E+00,</sup>  
.00000000E+00, .00000000E+00, .00000000E+00,

**WFLAP2 =** .4900000E+02, -.4900000E+02, .6938888E+02,  
**WELAP2 =** .1200000E+02, .6650000E+00,

**NFLAP3** = .14000000E+03, .40000000E+02, .10000000E+01,  
.30000000E+02, .10000000E+01,  
**FLAPC** = .30000000E+00, .30000000E+00, .30000000E+00,

**•100000000E+02, •100000000E+02, •250000000E+02, •250000000**  
**•500000000E+02, •500000000E+02, •250000000E+02, •250000000**  
**•250000000E+02, •250000000E+02, •250000000E+02, •250000000**

+25000000E+00, +25000000E+00, +25000000E+00, +25000000E+00,  
+25000000E+00, +25000000E+00, +25000000E+00, +25000000E+00,  
+25000000E+00, +25000000E+00, +25000000E+00, +25000000E+00,  
+25000000E+00, +25000000E+00, +25000000E+00, +25000000E+00,

```

    .25000000E+02,   .25000000E+02,   .25000000E+00,   .25000000
    .25000000E+00,   .25000000E+00,   .25000000E+00,
TABC =   .80000000E-01,   .80000000E-01,   .80000000E-01,

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ORIGINAL PAGE IS  
OF POOR QUALITY

6.2 EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

```

.30000000E+01, .30000000E+01, .12500000E+00, .12500000E+00,
.10000000E+00, .10000000E+00, .12500000E+00, .12500000E+00,
.12500000E+00, .12500000E+00, .12500000E+00, .12500000E+00,
.12500000E+00, .12500000E+00, .12500000E+00, .12500000E+00,
.12500000E+00, .12500000E+00, .12500000E+00, .12500000E+00,
.12500000E+00, .12500000E+00, .12500000E+00, .12500000E+00,
WSMOTH = .10000000E+00,
KCG = .00000000E+00,
YCG = .00000000E+00,
ZCG = .00000000E+00,
REFS = .82000000E+04,
REFC = .32681000E+02,
REFB = .28000000E+03,
NJOB = +1,
ALFA = .10000000E+02, .00000000E+00, .00000000E+00,
.00000000E+00, .00000000E+00, .00000000E+00, .00000000E+00,
.00000000E+00, .00000000E+00, .00000000E+00, .00000000E+00,
.00000000E+00, .00000000E+00, .00000000E+00, .00000000E+00,
.00000000E+00, .00000000E+00, .00000000E+00, .00000000E+00,
MACHN = .20000000E+00, .00000000E+00, .00000000E+00,
.00000000E+00, .00000000E+00, .00000000E+00, .00000000E+00,
.00000000E+00, .00000000E+00, .00000000E+00, .00000000E+00,
HEIGHT = .10000000E+05, .10000000E+05, .10000000E+05,
.10000000E+05, .10000000E+05, .10000000E+05, .10000000E+05,
.10000000E+05, .10000000E+05, .10000000E+05, .10000000E+05,
FLAPD = .40000000E+02, -.30000000E+02, .00000000E+00,
.30000000E+02, .00000000E+00, .00000000E+00,
TABD = .00000000E+00, .00000000E+00, .00000000E+00,
.00000000E+00, .00000000E+00, .00000000E+00,
AILD = -.20000000E+02, .15000000E+02, .00000000E+00,
.00000000E+00, .00000000E+00, .00000000E+00,
.00000000E+00, .00000000E+00, .00000000E+00,
NFLG = +28, +8, +2, +3,
+2, +4, +3, +4,
+4, +6, +1, +1,
+0, +1, +0, +0,
+0, +1, +1, +4,
+0, +0, +0, +0,
+0, +0, +0, +0,
NSOLV = +0, +0, +0, +0,
SEND
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```

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
 VALUE 28 8 2 3 2 4 3 4 4 0 1 1 0 1 0 0 0 1 1 4 ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 2

SURFACE # 1 = WING  
 \*\*\*\*\* LIFTING SURFACE NO. 1 \*\*\*\*\*  
 SPAN ROOT TIP KNOT TIP AREA ASPECT MEAN MGC YBAR XBAR ZBAR  
 CHORD CHORD TWIST TWIST DEFLEC DEFLEC CHORD (MGC) (MGC) (MGC) (MGC)  
 280.000 40.000 10.000 4.0000 -1.0000 8199.59 9.5615 29.284 32.681 56.591 5.489 -5.655  
 FLAP FLAP FLAP TAB LAIL RAIL DIHED SWEEP NO.SPAN NO.CHORD NO.CHORD  
 SPAN1 SPAN2 SPAN3 DEFLC DEFLC DEFLC MGC/4 MGC/4 ELEMENTS ELEMENTS DISCONT.  
 +000 40.000 140.000 40.000 .000 -20.000 15.000 10.000 12.494 28 4 1  
 FUS STA WING STA WL STA AREA CHORD SPAN  
 X(STA) Y(LG) Z(CGI) S(CGI) C(CGI) B(CGI)  
 +000 .000 .000 8200.000 32.681 280.000

WS	Y	Z	X(LE)	X(L/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-141.543	-140.000	-17.633	20.000	22.500	30.000	-1.000	-10.000	-12.494	10.000	3.000	.800
-127.388	-126.761	-15.175	15.010	19.364	30.000	-3.303	-10.000	-12.494	14.182	4.255	1.135
-113.234	-112.122	-12.717	11.050	16.227	30.000	.394	-10.000	-12.494	16.364	5.509	1.469
-99.080	-98.182	-10.259	7.455	13.091	30.000	1.091	-10.000	-12.494	22.545	6.764	1.804
-84.926	-84.243	-7.801	5.255	9.955	30.000	1.788	-10.000	-12.494	26.727	8.018	2.138
-70.771	-70.344	-5.343	-5.909	0.818	30.000	2.485	-10.000	-12.494	30.905	9.273	2.473
-56.617	-56.365	-2.886	-10.091	3.682	30.000	3.182	-10.000	-12.494	35.091	10.527	2.807
-42.463	-42.425	-4.428	-9.272	.546	31.000	3.879	-10.000	-12.494	39.272	11.782	3.142
-28.309	-28.309	.000	-10.000	.000	30.000	4.000	.000	.000	40.000	12.000	3.200
-14.154	-14.154	.000	-10.000	.000	30.000	4.000	.000	.000	40.000	12.000	3.200
.000	.000	.000	-10.000	.000	30.000	4.000	.000	.000	40.000	12.000	3.200
14.154	14.154	.000	-10.000	.000	30.000	4.000	.000	.000	40.000	12.000	3.200
28.309	28.309	.000	-10.000	.000	30.000	4.000	.000	.000	40.000	12.000	3.200
42.463	42.425	-.428	-9.272	.546	30.000	3.879	10.000	12.494	39.272	11.782	3.142
56.617	56.365	-2.886	-10.091	3.682	31.000	3.182	10.000	12.494	35.091	10.527	2.807
70.771	70.344	-5.343	-5.909	0.818	31.000	2.485	10.000	12.494	30.905	9.273	2.473
84.926	84.243	-7.801	5.255	9.955	30.000	1.788	10.000	12.494	26.727	8.018	2.138
99.080	98.182	-10.259	7.455	13.091	30.000	1.091	10.000	12.494	22.545	6.764	1.804
113.234	112.122	-12.717	11.050	16.227	30.000	.394	10.000	12.494	18.364	5.509	1.469
127.388	126.761	-15.175	15.010	19.364	30.000	-3.303	10.000	12.494	14.182	4.255	1.135
141.543	140.000	-17.633	20.000	22.500	30.000	-1.000	10.000	12.494	10.000	3.000	.800

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
 VALUE 28 8 2 3 2 4 3 4 4 0 1 1 0 1 0 0 0 1 1 4 ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 3

X	Y	Z	X(1)/C	X(2)/C	X(3)/C	X(4)/C	X(5)/C	X(6)/C	X(7)/C	X(8)/C	X(9)/C	X(10)/C
30.0000	.0000	.0000	.0000	1.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
30.0000	40.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
30.0000	140.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

6.2 EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

J	K	Y	Z	WL	EW	DWL	DC	DS
1	1	-1.350+02	-1.664+01	1.365+02	1.365+02	1.311+01	2.333+00	2.711+01
2	1	-1.251+02	-1.495+01	1.264+02	1.264+02	1.711+01	3.030+00	3.416+01
3	1	-1.151+02	-1.331+01	1.163+02	1.163+02	1.011+01	3.727+00	4.121+01
4	1	-1.052+02	-1.171+01	1.062+02	1.062+02	1.011+01	4.424+00	4.825+01
5	1	-9.520+01	-1.016+01	9.605+01	9.605+01	1.311+01	5.121+00	5.530+01
6	1	-8.524+01	-8.644+00	8.594+01	8.594+01	1.011+01	5.810+00	6.235+01
7	1	-7.528+01	-7.176+00	7.583+01	7.583+01	1.311+01	6.515+00	6.939+01
8	1	-6.533+01	-5.747+00	6.572+01	6.572+01	1.011+01	7.212+00	7.644+01
9	1	-5.537+01	-4.364+00	5.581+01	5.581+01	1.011+01	7.909+00	8.348+01
10	1	-4.541+01	-3.023+00	4.550+01	4.550+01	1.011+01	8.606+00	9.053+01
11	1	-3.538+01	-2.336+00	3.539+01	3.539+01	1.011+01	9.302+00	9.421+01
12	1	-2.528+01	-2.378+00	2.528+01	2.528+01	1.011+01	9.333+00	9.436+01
13	1	-1.517+01	-2.378+00	1.517+01	1.517+01	1.011+01	9.333+00	9.436+01
14	1	-5.155+00	-3.086+00	5.155+00	5.155+00	1.011+01	9.333+00	9.436+01
15	1	5.055+00	-2.388+00	5.055+00	5.055+00	1.011+01	9.333+00	9.436+01
16	1	1.517+01	-2.388+00	1.517+01	1.517+01	1.011+01	9.333+00	9.436+01
17	1	2.528+01	-2.388+00	2.528+01	2.528+01	1.011+01	9.333+00	9.436+01
18	1	3.538+01	-2.336+00	3.539+01	3.539+01	1.011+01	9.333+00	9.421+01
19	1	4.541+01	-3.023+00	4.550+01	4.550+01	1.011+01	9.303+00	9.053+01
20	1	5.537+01	-4.364+00	5.581+01	5.581+01	1.011+01	8.606+00	8.348+01
21	1	6.533+01	-5.747+00	6.572+01	6.572+01	1.011+01	7.909+00	7.644+01
22	1	7.528+01	-7.174+00	7.583+01	7.583+01	1.011+01	7.212+00	6.939+01
23	1	8.524+01	-8.644+00	8.594+01	8.594+01	1.011+01	6.515+00	6.235+01
24	1	9.520+01	-1.016+01	9.605+01	9.605+01	1.011+01	5.818+00	5.530+01
25	1	1.052+02	-1.171+01	1.062+02	1.062+02	1.011+01	5.121+00	4.825+01
26	1	1.151+02	-1.331+01	1.163+02	1.163+02	1.011+01	4.424+00	4.121+01
27	1	1.251+02	-1.495+01	1.264+02	1.264+02	1.011+01	3.727+00	3.416+01
28	1	1.350+02	-1.664+01	1.365+02	1.365+02	1.011+01	3.039+00	2.711+01
1	2	-1.350+02	-1.667+01	1.365+02	1.365+02	1.011+01	2.333+00	2.711+01
2	2	-1.251+02	-1.497+01	1.264+02	1.264+02	1.011+01	3.030+00	3.416+01
3	2	-1.151+02	-1.329+01	1.163+02	1.163+02	1.011+01	3.727+00	4.121+01
4	2	-1.052+02	-1.165+01	1.062+02	1.062+02	1.011+01	4.424+00	4.825+01
5	2	-9.520+01	-1.004+01	9.605+01	9.605+01	1.011+01	5.121+00	5.530+01

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20    EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
VALUE 28 8 2 3 2 4 3 4 4 0 1 1 0 1 0 0 1 1 4    ALFA= .00 MACHNU= .0000 ALTITUDE=\*\*\*\*\* 4

J	K	Y	Z	WL	EW	DWL	DC	DS
6	2	-8.524+01	-8.455+00	8.594+01	8.594+01	1.011+01	5.818+00	6.235+01
7	2	-7.528+01	-6.905+00	7.583+01	7.583+01	1.011+01	6.515+00	6.939+01
8	2	-6.533+01	-5.385+00	6.572+01	6.572+01	1.011+01	7.212+00	7.644+01
9	2	-5.537+01	-3.896+00	5.581+01	5.581+01	1.011+01	7.909+00	8.348+01
10	2	-4.541+01	-2.436+00	4.550+01	4.550+01	1.011+01	8.606+00	9.053+01
11	2	-3.538+01	-1.686+00	3.539+01	3.539+01	1.011+01	9.303+00	9.421+01
12	2	-2.528+01	-1.655+00	2.528+01	2.528+01	1.011+01	9.333+00	9.436+01
13	2	-1.517+01	-1.655+00	1.517+01	1.517+01	1.011+01	9.333+00	9.436+01
14	2	-5.055+00	-1.655+00	5.055+00	5.055+00	1.011+01	9.333+00	9.436+01
15	2	5.055+00	-1.655+00	5.055+00	5.055+00	1.011+01	9.333+00	9.436+01
16	2	1.517+01	-1.655+00	1.517+01	1.517+01	1.011+01	9.333+00	9.436+01
17	2	2.528+01	-1.655+00	2.528+01	2.528+01	1.011+01	9.333+00	9.436+01
18	2	3.538+01	-1.686+00	3.539+01	3.539+01	1.011+01	9.333+00	9.421+01
19	2	4.541+01	-2.436+00	4.550+01	4.550+01	1.011+01	9.303+00	9.053+01
20	2	5.537+01	-3.896+00	5.581+01	5.581+01	1.011+01	8.606+00	8.348+01
21	2	6.533+01	-5.385+00	6.572+01	6.572+01	1.011+01	7.909+00	7.644+01
22	2	7.528+01	-6.905+00	7.583+01	7.583+01	1.011+01	7.212+00	6.939+01
23	2	8.524+01	-8.455+00	8.594+01	8.594+01	1.011+01	6.515+00	6.235+01
24	2	9.520+01	-1.004+01	9.605+01	9.605+01	1.011+01	5.818+00	5.530+01
25	2	1.052+02	-1.165+01	1.062+02	1.062+02	1.011+01	5.121+00	4.825+01
26	2	1.151+02	-1.329+01	1.163+02	1.163+02	1.011+01	4.424+00	4.121+01
27	2	1.251+02	-1.487+01	1.264+02	1.264+02	1.011+01	3.727+00	3.416+01
28	2	1.350+02	-1.667+01	1.365+02	1.365+02	1.011+01	3.039+00	2.711+01
1	3	-1.350+02	-1.677+01	1.365+02	1.365+02	1.011+01	2.333+00	2.711+01
2	3	-1.251+02	-1.458+01	1.266+02	1.266+02	1.011+01	3.033+00	3.416+01
3	3	-1.151+02	-1.327+01	1.163+02	1.163+02	1.011+01	3.727+00	4.121+01
4	3	-1.052+02	-1.159+01	1.062+02	1.062+02	1.011+01	4.424+00	4.825+01
5	3	-9.520+01	-9.517+00	9.605+01	9.605+01	1.011+01	5.121+00	5.530+01
6	3	-8.524+01	-8.267+00	8.594+01	8.594+01	1.011+01	5.818+00	6.235+01
7	3	-7.528+01	-6.635+00	7.583+01	7.583+01	1.011+01	6.515+00	6.939+01
8	3	-6.533+01	-5.622+00	6.572+01	6.572+01	1.011+01	7.212+00	7.644+01
9	3	-5.537+01	-3.428+00	5.561+01	5.561+01	1.011+01	7.909+00	8.348+01
10	3	-4.541+01	-1.653+00	4.550+01	4.550+01	1.011+01	8.606+00	9.053+01
11	3	-3.538+01	-1.036+00	3.539+01	3.539+01	1.011+01	9.303+00	9.421+01
12	3	-2.528+01	-1.032+00	2.528+01	2.528+01	1.011+01	9.333+00	9.436+01
13	3	-1.517+01	-1.032+00	1.517+01	1.517+01	1.011+01	9.333+00	9.436+01
14	3	-5.055+00	-1.032+00	5.055+00	5.055+00	1.011+01	9.333+00	9.436+01
15	3	5.055+00	-1.032+00	5.055+00	5.055+00	1.011+01	9.333+00	9.436+01
16	3	1.517+01	-1.032+00	1.517+01	1.517+01	1.011+01	9.333+00	9.436+01
17	3	2.528+01	-1.032+00	2.528+01	2.528+01	1.011+01	9.333+00	9.436+01
18	3	3.538+01	-1.036+00	3.539+01	3.539+01	1.011+01	9.333+00	9.421+01
19	3	4.541+01	-1.483+00	4.550+01	4.550+01	1.011+01	9.303+00	9.053+01
20	3	5.537+01	-3.428+00	5.561+01	5.561+01	1.011+01	8.606+00	8.348+01
21	3	6.533+01	-5.622+00	6.572+01	6.572+01	1.011+01	7.909+00	7.644+01
22	3	7.528+01	-6.635+00	7.583+01	7.583+01	1.011+01	7.212+00	6.939+01
23	3	8.524+01	-8.267+00	8.594+01	8.594+01	1.011+01	6.515+00	6.235+01
24	3	9.520+01	-9.517+00	9.605+01	9.605+01	1.011+01	5.818+00	5.530+01
25	3	1.052+02	-1.159+01	1.062+02	1.062+02	1.011+01	5.121+00	4.825+01

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20    EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
VALUE 28 8 2 3 2 4 3 4 4 0 1 1 0 1 0 0 1 1 4    ALFA= .00 MACHNU= .0000 ALTITUDE=\*\*\*\*\* 5

J	K	Y	Z	WL	EW	DWL	DC	DS
26	3	1.151+02	-1.327+01	1.163+02	1.163+02	1.011+01	4.424+00	4.121+01
27	3	1.251+02	-1.498+01	1.264+02	1.264+02	1.011+01	3.727+00	3.416+01
28	3	1.350+02	-1.670+01	1.365+02	1.365+02	1.011+01	3.030+00	2.711+01
1	4	-1.350+02	-1.674+01	1.365+02	1.365+02	1.011+01	3.000+00	3.486+01
2	4	-1.251+02	-1.500+01	1.264+02	1.264+02	1.011+01	3.896+00	4.392+01
3	4	-1.151+02	-1.325+01	1.163+02	1.163+02	1.011+01	4.792+00	5.258+01
4	4	-1.052+02	-1.151+01	1.062+02	1.062+02	1.011+01	5.688+00	6.204+01

6.2 EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

5	4	-4.520+01	-9.771+00	9.605+01	9.800+01	1.011+01	6.584+00	7.110+01
6	4	-8.524+01	-8.038+00	8.594+01	8.294+01	1.011+01	7.480+00	8.016+01
7	4	-7.526+01	-6.308+00	7.583+01	7.293+01	1.011+01	8.377+00	8.922+01
8	4	-6.533+01	-4.582+00	6.572+01	6.292+01	1.011+01	9.273+00	9.828+01
9	4	-5.537+01	-2.860+00	5.561+01	5.281+01	1.011+01	1.017+01	1.073+02
10	4	-6.541+01	-1.142+00	4.550+01	4.270+01	1.011+01	1.106+01	1.164+02
11	4	-3.538+01	-2.471+01	3.539+01	3.259+01	1.011+01	1.196+01	1.211+02
12	4	-2.520+01	-2.058+01	2.528+01	2.288+01	1.011+01	1.200+01	1.213+02
13	4	-1.517+01	-2.058+01	1.517+01	1.517+01	1.011+01	1.200+01	1.213+02
14	4	-5.755+02	-2.058+01	5.055+02	5.055+02	1.011+01	1.200+01	1.213+02
15	4	5.055+00	-2.058+01	5.055+00	5.055+00	1.011+01	1.200+01	1.213+02
16	4	1.517+01	-2.058+01	1.517+01	1.517+01	1.011+01	1.200+01	1.213+02
17	4	2.528+01	-2.058+01	2.528+01	2.528+01	1.011+01	1.200+01	1.213+02
18	4	3.539+01	-2.058+01	3.539+01	3.539+01	1.011+01	1.200+01	1.213+02
19	4	4.541+01	-1.142+00	4.550+01	4.270+01	1.011+01	1.196+01	1.164+02
20	4	5.537+01	-2.058+01	5.561+01	5.281+01	1.011+01	1.106+01	1.073+02
21	4	6.533+01	-4.582+00	6.572+01	6.292+01	1.011+01	1.017+01	9.828+01
22	4	7.528+01	-6.308+00	7.583+01	7.293+01	1.011+01	9.273+00	9.828+01
23	4	8.524+01	-8.038+00	8.594+01	8.294+01	1.011+01	8.377+00	8.916+01
24	4	9.520+01	-9.771+00	9.605+01	9.800+01	1.011+01	7.480+00	8.110+01
25	4	1.522+02	-1.151+01	1.062+02	1.062+02	1.011+01	6.584+00	6.204+01
26	4	1.515+02	-1.325+01	1.163+02	1.163+02	1.011+01	5.688+00	5.298+01
27	4	1.251+02	-1.505+01	1.264+02	1.264+02	1.011+01	4.792+00	4.392+01
28	4	1.350+02	-1.674+01	1.365+02	1.365+02	1.011+01	3.896+00	3.486+01

J	K	XV	YV	ZV	I XV	I YV	I ZV	XN	YN	ZN	I XN	I YN	I ZN
1	1	2.758+01	-1.400+02	-1.747+01	-2.003+01	9.496+01	1.620+01	2.052+01	-1.350+02	-1.664+01	1.237+02	-1.667+01	9.863+01
2	1	1.777+01	-1.330+02	-1.577+01	-2.003+01	9.573+01	1.575+01	1.805+01	-1.251+02	-1.495+01	3.919+03	-1.624+01	9.867+01
3	1	1.496+01	-1.201+02	-1.412+01	-2.007+01	9.510+01	1.529+01	1.559+01	-1.151+02	-1.331+01	-5.580+03	-1.600+01	9.871+01
4	1	1.215+01	-1.101+02	-1.252+01	-2.009+01	9.517+01	1.483+01	1.313+01	-1.052+02	-1.171+01	-1.311+02	-1.576+01	9.874+01
5	1	9.332+00	-1.002+02	-1.097+01	-2.009+01	9.523+01	1.437+01	1.066+01	-9.520+01	-1.016+01	-2.166+02	-1.552+01	9.876+01
6	1	6.520+00	-9.022+01	-9.465+00	-2.008+01	9.530+01	1.392+01	8.197+00	-8.524+01	-8.644+00	-3.022+02	-1.528+01	9.878+01
7	1	3.707+00	-8.126+01	-8.011+00	-2.004+01	9.536+01	1.345+01	5.732+00	-7.528+01	-7.174+00	-3.879+02	-1.503+01	9.879+01
8	1	8.942+01	-7.030+01	-6.007+00	-2.009+01	9.542+01	1.299+01	3.268+00	-6.533+01	-5.747+00	-4.737+02	-1.479+01	9.879+01
9	1	-1.919+00	-6.035+01	-5.251+00	-2.007+01	9.548+01	1.253+01	8.038+00	-5.537+01	-4.364+00	-5.595+02	-1.454+01	9.878+01
10	1	-9.731+00	-5.039+01	-3.945+00	-2.009+01	9.553+01	1.206+01	1.660+00	-4.541+01	-3.023+00	-6.454+02	-1.429+01	9.876+01
11	1	-7.544+00	-4.043+01	-2.688+00	-1.214+02	9.999+01	9.312+03	-2.946+00	-3.538+01	-2.336+00	-6.957+02	-6.144+03	9.976+01

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20    EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
VALUE 28 8 2 3 2 4 3 4 4 5 1 1 0 0 0 0 1 1 4    ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 6

J	K	XV	YV	ZV	I XV	I YV	I ZV	XN	YN	ZN	I XN	I YN	I ZN
12	1	-7.867+00	-3.033+01	-2.634+00	0.000	1.000+00	0.000	-3.000+00	-2.528+01	-2.308+00	-6.976+02	0.000	9.976+01
13	1	-7.867+01	-2.022+01	-2.634+00	0.000	1.000+00	0.000	-3.000+00	-1.517+01	-2.308+00	-6.976+02	0.000	9.976+01
14	1	-7.667+00	-1.011+01	-2.634+00	0.000	1.000+00	0.000	-3.000+00	-5.055+00	-2.308+00	-6.976+02	0.000	9.976+01
15	1	-7.667+00	1.907+06	-2.634+00	0.000	1.000+00	0.000	-3.000+00	5.055+00	-2.308+00	-6.976+02	0.000	9.976+01
16	1	-7.667+00	1.011+01	-2.634+00	0.000	1.000+00	0.000	-3.000+00	1.517+01	-2.308+00	-6.976+02	0.000	9.976+01
17	1	-7.667+00	2.022+01	-2.634+00	0.000	1.000+00	0.000	-3.000+00	2.528+01	-2.308+00	-6.976+02	0.000	9.976+01
18	1	-7.667+00	3.033+01	-2.634+00	1.214+02	9.999+01	-5.312+03	-2.946+00	3.538+01	-2.336+00	-6.957+02	6.144+03	9.976+01
19	1	-7.544+20	4.043+01	-2.688+00	2.009+01	9.533+01	-1.206+01	-1.660+00	4.541+01	-3.023+00	-6.454+02	1.429+01	9.876+01
20	1	-4.731+00	5.039+01	-3.045+00	2.007+01	9.548+01	-1.253+01	8.038+00	-4.364+01	-5.559+02	1.454+01	9.878+01	
21	1	-1.919+00	6.035+01	-5.251+00	2.009+01	9.542+01	-1.299+01	3.268+00	6.533+01	-5.747+00	-4.737+02	1.479+01	9.879+01
22	1	8.942+01	7.030+01	-6.007+00	2.009+01	9.536+01	-1.345+01	5.732+00	7.528+01	-7.174+00	-3.879+02	1.503+01	9.878+01
23	1	3.777+00	8.026+01	-8.011+00	2.007+01	9.530+01	-1.392+01	8.197+00	8.524+00	-8.644+00	-3.022+02	1.528+01	9.878+01
24	1	6.520+00	9.022+01	-9.465+00	2.009+01	9.523+01	-1.437+01	1.066+01	9.520+01	-1.016+01	-2.166+02	1.552+01	9.878+01
25	1	9.332+00	1.022+02	-1.197+01	2.009+01	9.517+01	-1.483+01	1.313+01	1.052+01	-1.171+01	-1.311+02	1.576+01	9.874+01
26	1	1.215+01	1.101+02	-1.252+01	2.007+01	9.510+01	-1.529+01	1.559+01	1.151+01	-1.331+01	-5.589+03	1.600+01	9.871+01
27	1	1.498+01	1.201+02	-1.412+01	2.005+01	9.503+01	-1.575+01	1.805+01	1.251+02	-1.495+01	3.919+03	1.624+01	9.867+01
28	1	1.777+01	1.300+02	-1.577+01	2.003+01	9.498+01	-1.620+01	2.052+01	1.350+02	-1.664+01	1.237+02	1.647+01	9.863+01

J	K	XV	YV	ZV	I XV	I YV	I ZV	XN	YN	ZN	I XN	I YN	I ZN	
1	2	2.292+01	-1.400+02	-1.751+01	-2.000+01	9.646+01	1.659+01	2.320+01	-1.350+02	-1.667+01	1.237+02	-1.670+01	9.859+01	
2	2	1.180+01	-1.300+02	-1.580+01	-2.001+01	9.652+01	1.625+01	2.143+01	-1.251+02	-1.497+01	3.918+03	-1.652+01	9.863+01	
3	2	1.869+01	-1.201+02	-1.412+01	-2.002+01	9.657+01	1.590+01	1.967+01	-1.151+02	-1.329+01	-4.578+03	-1.634+01	9.866+01	
4	2	1.657+01	-1.101+02	-1.248+01	-2.003+01	9.663+01	1.555+01	1.790+01	-1.052+02	-1.165+01	-3.107+02	-1.616+01	9.868+01	
5	2	1.445+01	-1.002+02	-1.088+01	-2.003+01	9.668+01	1.520+01	1.613+01	-9.520+01	-1.004+01	-2.164+02	-1.598+01	9.869+01	
6	2	1.234+01	-9.022+01	-8.314+00	-2.003+01	9.673+01	1.485+01	1.436+01	-8.524+01	-8.455+00	-3.019+02	1.579+01	9.870+01	
7	2	1.022+01	-8.026+01	-7.785+00	-2.005+01	9.678+01	1.450+01	1.260+01	-7.528+01	-6.904+00	-3.875+02	1.561+01	9.870+01	
8	2	8.106+00	-7.300+01	-6.294+00	-2.004+01	9.683+01	1.415+01	1.063+01	-5.733+01	-5.333+00	-5.385+00	-4.732+02	1.541+01	9.869+01
9	2	5.990+00	-6.035+01	-4.839+00	-2.005+01	9.688+01	1.379+01	9.761+00	-5.534+00	-5.894+00	-5.859+02	-1.324+01	9.867+01	
10	2	3.875+00	-5.039+01	-3.421+00	-2.006+01	9.693+01	1.344+01	7.294+00	-4.541+01	-4.243+00	-6.447+02	-1.505+01	9.865+01	
11	2	1.759+00	-4.043+01	-2.041+00	-2.007+01	9.699+01	1.373+01	6.372+00	-3.938+01	-3.168+00	-6.957+02	6.494+03	9.761+01	
12	2	1.667+00	-3.033+01	-1.981+00	-2.003+01	9.700+01	1.300+00	6.333+00	-3.151+01	-2.655+00	-6.976+02	0.000	9.976+01	
13	2	1.667+00	-2.022+01	-1.981+00	-2.003+01	9.705+01	1.300+00	6.333+00	-3.055+00	-2.655+00	-6.976+02	0.000	9.976+01	
14	2	1.667+00	-1.011+01	-1.981+00	-2.003+01	9.678+01	1.450+01	1.260+01	7.528+01	-6.904+00	-3.875+02	1.561+01	9.870+01	
15	2	1.667+00	1.907+06	-1.981+00	-2.003+01	9.668+01	1.000+00	6.333+00	5.055+00	-1.655+00	-6.976+02	0.000	9.976+01	
16	2	1.667+00	1.011+01	-1.981+00	-2.003+01	9.668+01	1.000+00	6.333+00	1.517+01	-1.655+00	-6.976+02	0.000	9.976+01	
17	2	1.667+00	2.022+01	-1.981+00	-2.003+01	9.667+01	1.000+00	6.333+00	2.528+01	-1.655+00	-6.976+02	0.000	9.976+01	
18	2	1.667+00	3.033+01	-1.981+00	9.129+00	9.699+01	-0.873+03	6.372+00	3.538+01	-1.686+00	-6.957+02	6.494+03	9.761+01	
19	2	1.759+00	4.043+01	-2.041+00	9.663+01	-1.344+01	7.294+00	4.941+01	-2.438+00	-6.447+02	0.000	9.865+01		
20	2	3.875+00	5.039+01</td											

6.2 EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

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7 3 1.674+01 -8.026+01 -7.559+00 -1.394+01 9.780-01 1.551-01 1.946+01 -7.528+01 -6.635+00 -3.872-02 -1.619-01 9.861-01
8 3 1.532+01 -7.030+01 -5.981+00 -1.394+01 9.784-01 1.527-01 1.839+01 -6.533+01 -5.022+00 -4.727-02 -1.676-01 9.859-01
9 3 1.390+01 -6.035+01 -4.427+01 -1.395+01 9.788-01 1.503-01 1.732+01 -5.537+01 -3.428+00 -5.583-02 -1.593-01 9.856-01
10 3 1.248+01 -5.039+01 -2.898+00 -1.395+01 9.791-01 1.479-01 1.625+01 -4.541+01 -1.853+00 -6.439-02 -1.580-01 9.853-01
11 3 1.106+01 -6.043+01 -1.394+00 -6.122+03 1.000+00 6.434-03 1.569+01 -3.538+01 -1.036+00 -6.957-02 -6.844-03 9.976-01
12 3 1.100+01 -3.033+01 -1.329+00 0.000 1.000+00 0.000 1.567+01 -2.528+01 -1.002+00 -6.976-02 0.000 9.976-01
13 3 1.100+01 -2.022+01 -1.329+00 0.000 1.000+00 0.000 1.567+01 -1.017+01 -1.002+00 -6.976-02 0.000 9.976-01
14 3 1.100+01 -1.011+01 -1.329+00 0.000 1.000+00 0.000 1.567+01 -5.055+00 -1.002+00 -6.976-02 0.000 9.976-01
15 3 1.100+01 -0.907+01 -1.329+00 0.000 1.000+00 0.000 1.567+01 -5.055+00 -1.002+00 -6.976-02 0.000 9.976-01
16 3 1.100+01 1.011+01 -1.329+00 0.000 1.000+00 0.000 1.567+01 1.517+01 -1.002+00 -6.976-02 0.000 9.976-01
17 3 1.100+01 2.022+01 -1.329+00 0.000 1.000+00 0.000 1.567+01 -2.528+01 -1.002+00 -6.976-02 0.000 9.976-01
18 3 1.100+01 3.033+01 -1.329+00 0.000 1.000+00 6.434-03 1.569+01 3.538+01 -1.036+00 -6.957-02 6.844-03 9.976-01
19 3 1.106+01 4.033+01 -1.394+00 1.395+01 9.791-01 -1.479-01 1.625+01 -4.541+01 -1.853+00 -6.439-02 1.580-01 9.853-01
20 3 1.248+01 5.039+01 -2.898+00 1.395+01 9.788-01 -1.503-01 1.732+01 -5.537+01 -3.428+00 -5.583-02 1.593-01 9.856-01
21 3 1.390+01 6.035+01 -4.427+01 1.395+01 9.784-01 -1.527-01 1.839+01 6.533+01 -5.022+00 -4.727-02 1.608-01 9.859-01
22 3 1.532+01 7.030+01 -5.981+00 1.395+01 9.780-01 -1.551-01 1.946+01 7.528+01 -6.635+00 -3.872-02 1.619-01 9.861-01
23 3 1.674+01 8.026+01 -7.559+00 1.395+01 9.777-01 -1.574-01 2.053+01 8.524+01 -8.267+00 -3.017+02 1.631-01 9.861-01
24 3 1.816+01 9.022+01 -9.016+00 1.395+01 9.773-01 -1.598-01 2.160+01 9.520+01 -9.170+00 -2.162-02 1.643-01 9.862-01
25 3 1.957+01 1.022+02 -1.079+01 1.394+01 9.769-01 -1.622-01 2.267+01 1.052+02 -1.159+01 -1.309-02 1.656-01 9.861-01
26 3 2.099+01 1.101+02 -1.244+01 1.394+01 9.765-01 -1.645-01 2.374+01 1.151+02 -1.327+01 -4.575-03 1.666-01 9.860-01
27 3 2.241+01 1.201+02 -1.412+01 1.394+01 9.761-01 -1.669-01 2.481+01 1.251+02 -1.498+01 3.914-03 1.680-01 9.858-01
28 3 2.383+01 1.300+02 -1.582+01 1.394-01 9.757-01 -1.692-01 2.588+01 1.359+02 -1.670+01 1.236-02 1.692-01 9.855-01

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JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
VALUE 28 8 2 3 2 4 3 4 4 4 4 4 4 1 1 1 0 0 0 1 1 4 ALFA= .00 MACHNO=.0000 ALTITUDE=\*\*\*\*\* B

J	K	XV	YV	ZV	TAV	IYV	IYV	I2V	XN	YN	ZN	IXN	LYN	IZN
25	4	2.506+01	1.002+02 -1.070+01	0.000+02	9.834-01 -1.686-01	2.847+01	1.052+02 -1.151+01	-1.308-02	1.698-01	9.854-01				
26	4	2.573+01	1.101+02 -1.260+01	0.000+02	9.833-01 -1.697-01	2.869+01	1.151+02 -1.325+01	-4.572-03	1.704-01	9.854-01				
27	4	2.641+01	1.201+02 -1.422+01	0.000+02	9.831-01 -1.708-01	2.891+01	1.251+02 -1.500+01	3.914-03	1.710-01	9.853-01				
28	4	2.708+01	1.300+02 -1.585+01	0.000+02	9.829-01 -1.720-01	2.914+01	1.350+02 -1.674+01	1.236-02	1.715-01	9.851-01				

(EOF PLUT FILE 1) FILE # 1 = WING GEOMETRY

SOLID LINE INDICATES THE OUTPUT HAS BEEN EDITED

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
VALUE 28 6 2 3 2 4 3 4 4 0 1 1 0 1 0 0 0 1 1 4 ALFA= .00 MACHNO=.0000 ALTITUDE=\*\*\*\*\* 9

LIFTING SURFACE NO. 2 SURFACE # 2 = HORIZONTAL TAIS  
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SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
87.720	30.000	20.000	-2.0000	-2.0000	2000.00	3.2000	25.000	25.333	18.667	131.000	-19.337
FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	DEFLEC DEFLEC DEFLEC	L.AIL R.AIL DEFLEC DEFLEC DEFLEC	DIHEO. MGC/4	SWEET NO. SPAN ELEMENTS	NO. CHORD ELEMENTS	DISCONT.			
40.000	40.000	-30.000	.000	.000	.000	10.620	8	3	1		
FUS STA XLOC YLOC ZLOC	WING STA XLOC YLOC ZLOC	HL STA XLOC YLOC ZLOC	AREA SICGJ CICGJ	CHOPD SPAN B(CG)	32.681	280.000					

ORIGINAL PAGE IS  
OF POOR QUALITY

WS	Y	Z	X(LC)	X(LC/4)	X(TC)	TWIST	DIHEO/C/4 SWEP/C/4	C(WING)	C(FLAP)	C(TAB)	
-60.000	-42.000	-20.000	130.000	130.000	150.000	-2.000	.000	-10.620	20.000	10.000	3.000
-36.000	-36.000	-20.000	124.000	124.250	151.000	-2.000	.000	-10.620	21.000	10.000	3.000
-32.000	-32.000	-20.000	120.000	123.500	151.000	-2.000	.000	-10.620	22.000	10.000	3.000
-28.000	-28.000	-20.000	127.000	127.750	151.100	-2.000	.000	-10.620	23.000	10.000	3.000
-24.000	-24.000	-20.000	120.000	120.000	151.300	-2.000	.000	-10.620	24.000	10.000	3.000
-20.000	-20.000	-20.000	122.000	122.250	151.000	-2.000	.000	-10.620	25.000	10.000	3.000
-16.000	-16.000	-20.000	124.000	124.500	151.000	-2.000	.000	-10.620	26.000	10.000	3.000
-12.000	-12.000	-20.000	125.000	125.750	151.000	-2.000	.000	-10.620	27.000	10.000	3.000
-8.000	-8.000	-20.000	122.000	122.000	151.000	-2.000	.000	-10.620	28.000	10.000	3.000
-4.000	-4.000	-20.000	121.000	120.250	151.000	-2.000	.000	-10.620	29.000	10.000	3.000
0.000	-20.000	120.000	127.500	127.750	151.000	-2.000	-969	30.866	30.000	10.000	3.000
4.000	4.000	-20.000	121.000	120.250	151.000	-2.000	.000	10.620	29.000	10.000	3.000
8.000	8.000	-20.000	124.000	124.500	151.000	-2.000	.000	10.620	28.000	10.000	3.000
12.000	12.000	-20.000	123.000	123.750	151.000	-2.000	.000	10.620	27.000	10.000	3.000
16.000	16.000	-20.000	124.000	125.000	151.000	-2.000	.000	10.620	26.000	10.000	3.000
20.000	20.000	-20.000	125.000	125.250	151.000	-2.000	.000	10.620	25.000	10.000	3.000
24.000	24.000	-20.000	120.000	120.100	151.000	-2.000	.000	10.620	24.000	10.000	3.000
28.000	28.000	-20.000	127.000	127.750	151.000	-2.000	.000	10.620	23.000	10.000	3.000
32.000	32.000	-20.000	120.000	120.500	151.000	-2.000	.000	10.620	22.000	10.000	3.000
36.000	36.000	-20.000	124.000	124.250	151.000	-2.000	.000	10.620	21.000	10.000	3.000
40.000	40.000	-20.000	130.000	130.000	151.000	-2.000	.000	10.620	20.000	10.000	3.000

6.2 EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

35	3	1.425+02	1.000+01	-1.974+01	0.000	1.000+00	0.000	1.475+02	1.500+01	-1.991+01	3.490-02	0.000	9.994-01
36	3	1.425+02	2.000+01	-1.974+01	0.000	1.000+00	0.000	1.475+02	2.500+01	-1.991+01	3.490-02	0.000	9.994-01
37	3	1.425+02	3.000+01	-1.974+01	0.000	1.000+00	0.000	1.475+02	3.500+01	-1.991+01	3.490-02	0.000	9.994-01

FILE # 2 = HORIZONTAL TAIL GEOMETRY

(EOF PLOT FILE 2)

OK TO IGNORE

\* DIVIDE CHECK AT 026642

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
VALUE 28 8 2 3 2 4 3 4 4 0 1 1 0 0 0 0 1 1 4 ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 12

SURFACE # 3 = FUSELAGE

LIFTING SURFACE NO= 3

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SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MGC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
.000	80.000	200.000	.0000	.0000	.06	.0000	.000	148.568	.000	-12.858	-11.428
FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	DIHED.	SWEET	NO. SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
.000	.000	1.000	.000	.000	.000	.000	MGC/4	MGC/4	2	4	0
FUS STA X(LLG)	WING STA Y(LCG)	WL STA Z(LCG)			AREA S(CG)	CHORD C(CG)	SPAN B(CG)				
.000	.000	.000			.000 8200.000	32.681	280.000				

WS	Y	Z	X(LE)	X(L/4)	X(TE)	TWIST	DIHE(C/4)	SWEET(C/4)	C(WING)	C(FLAP)	C(TAB)
-20.000	.000	-20.000	-50.000	.000	150.000	.000	-89.999	-56.310	200.000	50.000	25.000
-18.000	.000	-18.000	-50.000	-3.000	138.000	.000	-89.999	-56.310	188.000	47.000	23.500
-16.000	.000	-16.000	-50.000	-9.000	126.000	.000	-89.999	-56.310	176.000	44.000	22.000
-14.000	.000	-14.000	-50.000	-15.000	114.000	.000	-89.999	-56.310	164.000	41.000	20.500
-12.000	.000	-12.000	-50.000	-21.000	102.000	.000	-89.999	-56.310	152.000	38.000	19.000
-10.000	.000	-10.000	-50.000	-25.000	90.000	.000	-89.999	-56.310	140.000	35.000	17.500
-8.000	.000	-8.000	-50.000	-31.000	78.000	.000	-89.999	-56.310	128.000	32.000	16.000
-6.000	.000	-6.000	-50.000	-37.000	66.000	.000	-89.999	-56.310	116.000	29.000	14.500
-4.000	.000	-4.000	-50.000	-43.000	54.000	.000	-89.999	-56.310	104.000	26.000	13.000
-2.000	.000	-2.000	-50.000	-47.000	42.000	.000	-89.999	-56.310	92.000	23.000	11.500
.000	.000	.000	-50.000	-50.000	30.000	.000	26.565	-74.835	80.000	20.000	10.000
2.000	.000	-2.000	-50.000	-57.000	42.000	.000	89.999	56.310	92.000	23.000	11.500
4.000	.000	-4.000	-50.000	-54.000	54.000	.000	89.999	56.310	104.000	26.000	13.000
6.000	.000	-6.000	-50.000	-51.000	66.000	.000	89.999	56.310	116.000	29.000	14.500
8.000	.000	-8.000	-50.000	-48.000	78.000	.000	89.999	56.310	128.000	32.000	16.000
10.000	.000	-10.000	-50.000	-45.000	90.000	.000	89.999	56.310	140.000	35.000	17.500
12.000	.000	-12.000	-50.000	-42.000	102.000	.000	89.999	56.310	152.000	38.000	19.000
14.000	.000	-14.000	-50.000	-39.000	114.000	.000	89.999	56.310	164.000	41.000	20.500
16.000	.000	-16.000	-50.000	-36.000	126.000	.000	89.999	56.310	176.000	44.000	22.000
18.000	.000	-18.000	-50.000	-33.000	138.000	.000	89.999	56.310	188.000	47.000	23.500
20.000	.000	-20.000	-50.000	-30.000	150.000	.000	89.999	56.310	200.000	50.000	25.000

39	4	1.125+02	0.000	-2.000+01	-9.790-01	0.000	2.009-01	8.125+01	0.000	-1.000+01	0.000	-1.000+00	0.000
40	4	1.500+01	0.000	0.000	9.790-01	0.000	-2.009-01	8.125+01	0.000	-1.000+01	0.000	1.000+00	0.000

FILE # 3 = FUSELAGE GEOMETRY

(EOF PLOT FILE 3)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
VALUE 28 8 2 3 2 4 3 4 4 0 1 1 0 0 0 0 1 1 4 ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 14

SURFACE # 4 = VERTICAL FINNS

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SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MGC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
30.000	25.000	10.000	.0000	.0000	525.00	1.7143	17.500	18.571	40.000	138.072	-22.857
FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	DIHED.	SWEET	NO. SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
.000	30.000	30.000	.000	.000	.000	.000	MGC/4	MGC/4	3	4	1
FUS STA X(LLG)	WING STA Y(LCG)	WL STA Z(LCG)			AREA S(CG)	CHORD C(CG)	SPAN B(CG)				
.000	.000	.000			.000 8200.000	32.681	280.000				

WS	Y	Z	X(LE)	X(L/4)	X(TE)	TWIST	DIHE(C/4)	SWEET(C/4)	C(WING)	C(FLAP)	C(TAB)
.000	40.000	-10.000	125.000	131.250	150.000	.000	-14.036	72.560	25.000	12.500	2.500
1.500	40.000	-11.500	125.750	131.812	150.000	.000	89.999	20.556	24.250	12.125	2.425
3.000	40.000	-13.000	126.500	132.375	150.000	.000	89.999	20.556	23.500	11.750	2.350
4.500	40.000	-14.500	127.250	133.937	150.000	.000	89.999	20.556	22.750	11.375	2.275
6.000	40.000	-16.000	128.000	133.500	150.000	.000	89.999	20.556	22.000	11.000	2.200
7.500	40.000	-17.500	128.750	134.062	150.000	.000	89.999	20.556	21.250	10.625	2.125
9.000	40.000	-19.000	129.500	134.625	150.000	.000	89.999	20.556	20.500	10.250	2.050
10.500	40.000	-20.500	130.250	135.187	150.000	.000	89.999	20.556	19.750	9.875	1.975
12.000	40.000	-22.000	131.000	135.750	150.000	.000	89.999	20.556	19.000	9.500	1.900
13.500	40.000	-23.500	131.750	136.312	150.000	.000	89.999	20.556	18.250	9.125	1.825
15.000	40.000	-25.000	132.500	136.875	150.000	.000	89.999	20.556	17.500	8.750	1.750
16.500	40.000	-26.500	133.250	137.437	150.000	.000	89.999	20.556	16.750	8.375	1.675
18.000	40.000	-28.000	134.000	138.000	150.000	.000	89.999	20.556	16.000	8.000	1.600
19.500	40.000	-29.500	134.750	138.562	150.000	.000	89.999	20.556	15.250	7.625	1.525
21.000	40.000	-31.000	135.500	139.125	150.000	.000	89.999	20.556	14.500	7.250	1.450
22.500	40.000	-32.500	136.250	139.687	150.000	.000	89.999	20.556	13.750	6.875	1.375
24.000	40.000	-34.000	137.000	140.250	150.000	.000	89.999	20.556	13.000	6.500	1.300
25.500	40.000	-35.500	137.750	140.812	150.000	.000	89.999	20.556	12.250	6.125	1.225
27.000	40.000	-37.000	138.500	141.375	150.000	.000	89.999	20.556	11.500	5.750	1.150
28.500	40.000	-38.500	139.250	141.937	150.000	.000	89.999	20.556	10.750	5.375	1.075
30.000	40.000	-40.000	140.000	142.500	150.000	.000	89.999	20.556	10.000	5.000	1.000

6.2 EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
VALUE 28 8 2 3 2 4 3 4 4 0 1 0 1 0 0 0 1 1 1 4 ALFA= .00 MACHNO= .000C ALTITUDE=\*\*\*\*\* 15

X	Y	Z	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
150.0000	40.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
150.0000	40.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

J	K	Y	Z	WL	EW	DWL	DC	DS
42	1	4.000+01	-1.500+01	5.000+00	4.325+02	1.000+01	4.167+00	3.750+01
43	1	4.000+01	-2.500+01	1.500+01	4.425+02	1.000+01	3.333+00	2.917+01
44	1	4.000+01	-3.500+01	2.500+01	4.525+02	1.000+01	2.500+00	2.083+01
42	2	4.000+01	-1.500+01	5.000+00	4.325+02	1.000+01	4.167+00	3.750+01
43	2	4.000+01	-2.500+01	1.500+01	4.425+02	1.000+01	3.333+00	2.917+01
44	2	4.000+01	-3.500+01	2.500+01	4.525+02	1.000+01	2.500+00	2.083+01
42	3	4.000+01	-1.500+01	5.000+00	4.325+02	1.000+01	4.167+00	3.750+01
43	3	4.000+01	-2.500+01	1.500+01	4.425+02	1.000+01	3.333+00	2.917+01
44	3	4.000+01	-3.500+01	2.500+01	4.525+02	1.000+01	2.500+00	2.083+01
42	4	4.000+01	-1.500+01	5.000+00	4.325+02	1.000+01	4.167+00	3.750+01
43	4	4.000+01	-2.500+01	1.500+01	4.425+02	1.000+01	4.000+01	8.750+01
44	4	4.000+01	-3.500+01	2.500+01	4.525+02	1.000+01	7.500+00	6.250+01

INPUT SURFACE

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
VALUE 28 8 2 3 2 4 3 4 4 0 1 1 0 0 0 1 1 1 4 ALFA= .00 MACHNO= .000C ALTITUDE=\*\*\*\*\* 16

J	K	XV	YY	ZV	1XV	1YY	1ZV	XN	YN	ZN	1XN	1YN	1ZN
44	4	1.444+02	4.000+01	-3.000+01	1.843-01	0.000	-9.829-01	1.484+02	4.000+01	-3.500+01	0.000	1.000+00	0.000
EOF PLOT FILE 4) FILE # 4 = LEFT VERTICAL FIN GEOMETRY													
J	K	Y	Z	WL	EW	DWL	DC	DS					
42	1	-4.000+01	-1.500+01	5.000+00	4.325+02	1.000+01	4.167+00	3.750+01					
43	1	-4.000+01	-2.500+01	1.500+01	4.425+02	1.000+01	3.333+00	2.917+01					
44	1	-4.000+01	-3.500+01	2.500+01	4.525+02	1.000+01	2.500+00	2.083+01					
46	1	4.000+01	-1.500+01	5.000+00	4.325+02	1.000+01	4.167+00	3.750+01					
47	1	4.000+01	-2.500+01	1.500+01	4.425+02	1.000+01	3.333+00	2.917+01					
48	1	4.000+01	-3.500+01	2.500+01	4.525+02	1.000+01	2.500+00	2.083+01					
42	2	-4.000+01	-1.500+01	5.000+00	4.325+02	1.000+01	4.167+00	3.750+01					
43	2	-4.000+01	-2.500+01	1.500+01	4.425+02	1.000+01	3.333+00	2.917+01					
44	2	-4.000+01	-3.500+01	2.500+01	4.525+02	1.000+01	2.500+00	2.083+01					
46	2	4.000+01	-1.500+01	5.000+00	4.325+02	1.000+01	4.167+00	3.750+01					
47	2	4.000+01	-2.500+01	1.500+01	4.425+02	1.000+01	3.333+00	2.917+01					
48	2	4.000+01	-3.500+01	2.500+01	4.525+02	1.000+01	2.500+00	2.083+01					
42	3	-4.000+01	-1.500+01	5.000+00	4.325+02	1.000+01	4.167+00	3.750+01					
43	3	-4.000+01	-2.500+01	1.500+01	4.425+02	1.000+01	3.333+00	2.917+01					
44	3	-4.000+01	-3.500+01	2.500+01	4.525+02	1.000+01	2.500+00	2.083+01					
46	3	4.000+01	-1.500+01	5.000+00	4.325+02	1.000+01	4.167+00	3.750+01					
47	3	4.000+01	-2.500+01	1.500+01	4.425+02	1.000+01	3.333+00	2.917+01					
48	3	4.000+01	-3.500+01	2.500+01	4.525+02	1.000+01	2.500+00	2.083+01					
42	4	-4.000+01	-1.500+01	5.000+00	4.325+02	1.000+01	4.167+00	3.750+01					
43	4	-4.000+01	-2.500+01	1.500+01	4.425+02	1.000+01	4.000+01	8.750+01					
44	4	-4.000+01	-3.500+01	2.500+01	4.525+02	1.000+01	7.500+00	6.250+01					
46	4	4.000+01	-1.500+01	5.000+00	4.325+02	1.000+01	4.167+00	3.750+01					
47	4	4.000+01	-2.500+01	1.500+01	4.425+02	1.000+01	4.000+01	8.750+01					
48	4	4.000+01	-3.500+01	2.500+01	4.525+02	1.000+01	7.500+00	6.250+01					

INPUT SURFACE + IMAGE SURFACE  
(NNTAIL MINUS)

J	K	XV	YY	ZV	1XV	1YY	1ZV	XN	YN	ZN	1XN	1YN	1ZN
42	1	1.200+02	-4.000+01	-1.000+01	4.324+02	0.210	-9.018-01	1.303+02	-4.000+01	-1.500+01	0.000	1.000+00	0.000
43	1	1.308+02	-4.000+01	-2.000+01	4.324+02	0.200	-9.018-01	1.347+02	-4.000+01	-2.500+01	0.000	1.000+00	0.000
44	1	1.356+02	-4.000+01	-3.000+01	4.324+02	0.200	-9.018-01	1.391+02	-4.000+01	-3.500+01	0.000	1.000+00	0.000
46	1	1.260+02	4.000+01	-1.000+01	4.324+02	0.200	-9.018-01	1.373+02	4.000+01	-1.500+01	0.000	1.000+00	0.000
47	1	1.308+02	4.000+01	-2.000+01	4.324+02	0.200	-9.018-01	1.347+02	4.000+01	-2.500+01	0.000	1.000+00	0.000
48	1	1.356+02	4.000+01	-3.000+01	4.324+02	0.200	-9.018-01	1.391+02					

J	K	XV	YY	ZV	1XV	1YY	1ZV	XN	YN	ZN	1XN	1YN	1ZN
42	2	1.381+02	-4.000+01	-3.000+01	4.325+02	0.200	-9.298-01	1.411+02	-4.000+01	-3.500+01	0.000	1.000+00	0.000
46	2	1.302+02	4.000+01	-1.000+01	4.325+02	0.200	-9.298-01	1.341+02	4.000+01	-1.500+01	0.000	1.000+00	0.000
47	2	1.342+02	4.000+01	-2.000+01	4.325+02	0.200	-9.298-01	1.376+02	4.000+01	-2.500+01	0.000	1.000+00	0.000
48	2	1.381+02	4.000+01	-3.000+01	4.325+02	0.200	-9.298-01	1.411+02	4.000+01	-3.500+01	0.000	1.000+00	0.000
42	3	1.344+02	-4.000+01	-1.000+01	4.325+02	0.200	-9.545-01	1.378+02	-4.000+01	-1.500+01	0.000	1.000+00	0.000
43	3	1.375+02	-4.000+01	-2.000+01	4.325+02	0.200	-9.545-01	1.405+02	-4.000+01	-2.500+01	0.000	1.000+00	0.000
44	3	1.406+02	-4.000+01	-3.000+01	4.325+02	0.200	-9.545-01	1.432+02	-4.000+01	-3.500+01	0.000	1.000+00	0.000
46	3	1.344+02	4.000+01	-1.000+01	4.325+02	0.200	-9.545-01	1.378+02	4.000+01	-1.500+01	0.000	1.000+00	0.000
47	3	1.375+02	4.000+01	-2.000+01	4.325+02	0.200	-9.545-01	1.475+02	4.000+01	-2.500+01	0.000	1.000+00	0.000
48	3	1.406+02	4.000+01	-3.000+01	4.325+02	0.200	-9.545-01	1.432+02	4.000+01	-3.500+01	0.000	1.000+00	0.000
42	4	1.406+02	-4.000+01	-1.000+01	4.325+02	0.200	-9.829-01	1.472+02	-4.000+01	-1.500+01	0.000	1.000+00	0.000
43	4	1.425+02	-4.000+01	-2.000+01	4.325+02	0.200	-9.829-01	1.475+02	-4.000+01	-2.500+01	0.000	1.000+00	0.000
44	4	1.444+02	-4.000+01	-3.000+01	4.325+02	0.200	-9.829-01	1.484+02	-4.000+01	-3.500+01	0.000	1.000+00	0.000
46	4	1.406+02	4.000+01	-1.000+01	4.325+02	0.200	-9.829-01	1.472+02	4.000+01	-1.500+01	0.000	1.000+00	0.000
47	4	1.425+02	4.000+01	-2.000+01	4.325+02	0.200	-9.829-01	1.473+02	4.000+01	-2.500+01	0.000	1.000+00	0.000
48	4	1.444+02	4.000+01	-3.000+01	4.325+02	0.200	-9.829-01	1.484+02	4.000+01	-3.500+01	0.000	1.000+00	0.000

EOF PLOT FILE 5) FILE # 5 = RIGHT VERTICAL FIN GEOMETRY (IMAGE)

6.2 EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
VALUE 28 8 2 3 2 4 3 4 4 6 1 1 0 1 0 0 1 1 4 ALFA= .00 MACHNO=.0000 ALTITUDE=\*\*\*\*\* 18

SURFACE # 5 = ENGINE NACELLES

LIFTING SURFACE NO= 5  
\*\*\*\*\*

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	KBAR (EMGC)	ZBAR (MGC)
20.100	30.000	60.000	.0000	.0000	1050.00	.3817	52.500	54.285	40.000	-16.429	-.952
FLAP SPAN1 .000	FLAP SPAN2 .600	FLAP SPAN3 1.000	DEFLEL .000	DEFLEC .000	L.AIL .000	R.AIL .000	DIHED. 89.999	SWEEP MGC/4 36.870	NO. SPAN ELEMENTS 2	NO.CHORD ELEMENTS 6	NO.CHORD DISCONT. 0
FUS STA X(LG) .000	WING STA Y(LG) .000	WL STA Z(CG) .000	AREA SEC(G) 8200.000	CHORD C(CG) 32.681	SPAN B(CG) 280.000						

WS	Y	Z	X(LE)	A(X/Y)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(IFLAP)	C(TAB)
.000	40.000	10.000	-30.000	-24.500	.000	.000	89.999	-73.142	31.000	7.500	3.750
1.000	40.000	9.000	-30.000	-21.750	3.000	.000	89.999	36.870	33.000	8.250	4.125
2.000	40.000	8.000	-30.000	-21.000	6.000	.000	89.999	36.870	36.000	9.000	4.500
3.000	40.000	7.000	-30.000	-20.250	9.000	.000	89.999	36.870	39.000	9.750	4.875
4.000	40.000	6.000	-30.000	-19.500	12.000	.000	89.999	36.870	42.000	10.500	5.250
5.000	40.000	5.000	-30.000	-18.750	15.000	.000	89.999	36.870	45.000	11.250	5.625
6.000	40.000	4.000	-30.000	-18.000	18.000	.000	89.999	36.870	48.000	12.000	6.000
7.000	40.000	3.000	-30.000	-17.250	21.000	.000	89.999	36.870	51.000	12.750	6.375
8.000	40.000	2.000	-30.000	-16.500	24.000	.000	89.999	36.870	54.000	13.500	6.750
9.000	40.000	1.000	-30.000	-15.750	27.000	.000	89.999	36.870	57.000	14.250	7.125
10.000	40.000	.000	-30.000	-15.000	30.000	.000	89.999	36.870	60.000	15.000	7.500
11.000	40.000	-1.000	-30.000	-14.250	30.000	.000	89.999	.000	60.000	15.000	7.500
12.000	40.000	-2.000	-30.000	-13.500	30.000	.000	89.999	.000	60.000	15.000	7.500
13.000	40.000	-3.000	-30.000	-12.750	30.000	.000	89.999	.000	60.000	15.000	7.500
14.000	40.000	-4.000	-30.000	-12.000	30.000	.000	89.999	.000	60.000	15.000	7.500
15.000	40.000	-5.000	-30.000	-11.250	30.000	.000	89.999	.000	60.000	15.000	7.500
16.000	40.000	-6.000	-30.000	-10.500	30.000	.000	89.999	.000	60.000	15.000	7.500
17.000	40.000	-7.000	-30.000	-9.750	30.000	.000	89.999	.000	60.000	15.000	7.500
18.000	40.000	-8.000	-30.000	-9.000	30.000	.000	89.999	.000	60.000	15.000	7.500
19.000	40.000	-9.000	-30.000	-8.250	30.000	.000	89.999	.000	60.000	15.000	7.500
20.000	40.000	-10.000	-30.000	-7.500	30.000	.000	89.999	.000	60.000	15.000	7.500

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
VALUE 28 8 2 3 2 4 3 4 4 6 1 1 0 1 0 0 1 1 4 ALFA= .00 MACHNO=.0000 ALTITUDE=\*\*\*\*\* 20

J	K	XV	YY	ZV	I XV	I YY	I ZV	XN	YN	ZN	I XN	I YN	I ZN
50	5	-8.750+01	4.000+01	1.000+01	9.468-01	0.000	-4.258-01	5.625+00	4.000+01	5.000+00	0.000	1.000+00	0.000
51	5	1.250+01	4.000+01	0.000	0.000	0.000	-1.000+00	1.750+01	4.000+01	-5.000+00	0.000	1.000+00	0.000

FILE # 6 = LEFT ENGINE NACELLE GEOMETRY

J	K	Y	Z	ML	EM	DWL	DC	DS
50	1	-4.000+01	5.000+00	5.000+00	5.125+02	1.000+01	5.000+00	7.500+01
51	1	-4.000+01	-5.000+00	1.500+01	5.225+02	1.000+01	1.000+01	1.000+02

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
VALUE 28 8 2 3 2 4 3 4 4 6 1 1 0 1 0 0 1 1 4 ALFA= .00 MACHNO=.0000 ALTITUDE=\*\*\*\*\* 21

J	K	XV	YY	ZV	I XV	I YY	I ZV	XN	YN	ZN	I XN	I YN	I ZN
53	1	-2.875+01	4.000+01	1.000+01	1.240-01	0.000	-9.923-01	-2.438+01	4.000+01	5.000+00	0.000	1.000+00	0.000
54	1	-2.750+01	4.000+01	0.000	0.000	0.000	-1.000+00	-2.250+01	4.000+01	-5.000+00	0.000	1.000+00	0.000

J	K	XV	YY	ZV	I XV	I YY	I ZV	XN	YN	ZN	I XN	I YN	I ZN
50	2	-2.375+01	-4.000+01	1.000+01	5.300-01	0.000	-8.480-01	-1.688+01	-4.000+01	5.000+00	0.000	1.000+00	0.000
51	2	-1.750+01	-4.000+01	0.000	0.000	0.000	-1.000+00	-1.250+01	-4.000+01	-5.000+00	0.000	1.000+00	0.000

J	K	XV	YY	ZV	I XV	I YY	I ZV	XN	YN	ZN	I XN	I YN	I ZN
53	2	-2.375+01	4.000+01	1.000+01	5.300-01	0.000	-8.480-01	-1.688+01	4.000+01	5.000+00	0.000	1.000+00	0.000
54	2	-1.750+01	4.000+01	0.000	0.000	0.000	-1.000+00	-1.250+01	4.000+01	-5.000+00	0.000	1.000+00	0.000

J	K	XV	YY	ZV	I XV	I YY	I ZV	XN	YN	ZN	I XN	I YN	I ZN
50	3	-1.875+01	-4.000+01	1.000+01	7.474-01	0.000	-6.644-01	-9.375+00	-4.000+01	5.000+00	0.000	1.000+00	0.000
51	3	-7.500+01	-4.000+01	0.000	0.000	0.000	-1.000+00	-2.500+00	-4.000+01	-5.000+00	0.000	1.000+00	0.000

J	K	XV	YY	ZV	I XV	I YY	I ZV	XN	YN	ZN	I XN	I YN	I ZN
53	3	-1.875+01	4.000+01	1.000+01	7.474-01	0.000	-6.644-01	-9.375+00	4.000+01	5.000+00	0.000	1.000+00	0.000
54	3	-7.500+01	4.000+01	0.000	0.000	0.000	-1.000+00	-2.500+00	4.000+01	-5.000+00	0.000	1.000+00	0.000

J	K	XV	YY	ZV	I XV	I YY	I ZV	XN	YN	ZN	I XN	I YN	I ZN
50	4	-1.375+01	-4.000+01	1.000+01	8.517-01	0.000	-5.241-01	-1.875+00	-4.000+01	5.000+00	0.000	1.000+00	0.000
51	4	2.500+01	-4.000+01	0.000	0.000	0.000	-1.000+00	7.500+00	-4.000+01	-5.000+00	0.000	1.000+00	0.000

J	K	XV	YY	ZV	I XV	I YY	I ZV	XN	YN	ZN	I XN	I YN	I ZN
53	4	-1.375+01	4.000+01	1.000+01	8.517-01	0.000	-5.241-01	-1.875+00	4.000+01	5.000+00	0.000	1.000+00	0.000
54	4	2.500+01	4.000+01	0.000	0.000	0.000	-1.000+00	7.500+00	4.000+01	-5.000+00	0.000	1.000+00	0.000

J	K	XV	YY	ZV	I XV	I YY	I ZV	XN	YN	ZN	I XN	I YN	I ZN
50	5	-8.750+00	-4.000+01	1.000+01	9.460-01	0.000	-4.258-01	5.625+00	-4.000+01	5.000+00	0.000	1.000+00	0.000
51	5	1.250+01	-4.000+01	0.000	0.000	0.000	-1.000+01	1.750+01	-4.000+01	-5.000+00	0.000	1.000+01	0.000

J	K	XV	YY	ZV	I XV	I YY	I ZV	XN	YN	ZN	I XN	I YN	I ZN

<tbl\_r cells="14"

.2 EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

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JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20  EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE
VALUE 14 4 2 3 2 4 3 4 4 0 1 1 0 1 0 0 0 1 0 4  ALFA= .00 MACHNO= .0000 ALTITUDE=***** 22

$INPUT
KOUT = +6,
KT1 = +1,
KT2 = +8,
KT3 = +3,
LENX = +56,
NWING = +2,
NVTAIL = +0, } ONLY SURFACES # 1 AND 2, WING + TAIL ARE CONSIDERED NOW
NFUS =
COLOCP = .7500000E+00,
CUTDF1 = .1000000E-03,
CUTDF2 = +2000000E-02,
LFLAP =
GSCALE = +1000000E+01,
NSS =
+12,
NCS =
+2,
+2,
X = .3000000E+02, .3000000E+02, .3000000E+02,
.1500000E+03, .1500000E+03, -.5000000E+02, -.5000000E+02,
.1500000E+03, .1500000E+03, -.5000000E+02, -.5000000E+02,
-3000000E+02, -3000000E+02, .0000000E+00, .0000000E+00,
.0000000E+00, .0000000E+00, .0000000E+00, .0000000E+00,
.0000000E+00, .0000000E+00, .0000000E+00, .0000000E+00,
.0000000E+00, .0000000E+00, .0000000E+00, .0000000E+00,
Y = .0000000E+00,
.0000000E+00, .0000000E+00, .0000000E+00,
.0000000E+00, .0000000E+00, .0000000E+00, .0000000E+00,
.0000000E+00, .0000000E+00, .0000000E+00, .0000000E+00,
NFLG =
+14, +4, +4, +2, +3,
+4, +6, +1, +1,
+0, +1, +0, +0,
+0, +1, +0, +4,
NSOLV =
+1, +1, +1, +1, +2,
+0, +0, +0, +0, +0,
$END

```

ORIGINAL PAGE IS  
OF POOR QUALITY

```

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20  EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE
VALUE 14 4 2 3 2 4 3 4 4 0 1 1 0 1 0 0 0 1 0 4  ALFA= .00 MACHNO= .0000 ALTITUDE=***** 23

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SURFACE # 1 = WING  
\*\*\*\*\*

SPAN	ROOT CHORD	TIP CHORD	KOUT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
200.000	40.000	10.000	4.0000	-1.000	8199.59	9.5615	29.284	32.681	56.591	5.489	-5.655
FLAP SPAN1 .000	FLAP SPAN2 40.000	FLAP SPAN3 140.000	DEFLEC 30.000	TAB DEFLEC .000	L.TAIL DEFLEC -21.000	R.TAIL DEFLEC 15.000	DIHED. MGC/4 10.000	SHEEP MGC/4 12.494	NO.SPAN ELEMENTS 14	NO.CHORD ELEMENTS 4	NO.CHORD DISCONT. 1
FUS STA X(LOC) Y(LG)	WING STA Z(CCG)	WL STA S(CCG)	AREA C(CHG)	CHORD C(CCG)	SPAN B(CCG)						
-141.543 -140.000	-17.633 20.000	22.500 30.000	-1.000 -18.000	-12.494 1D.000	3.000 .800						
-127.388 -126.061	-15.175 15.000	19.366 30.000	-3.003 -17.000	-12.494 14.182	4.255 1.135						
-113.234 -112.122	-12.717 11.000	16.227 32.000	-3.94 -10.000	-12.494 18.364	5.509 1.469						

WS	Y	Z	X(LOC)	X(LG/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-141.543	-140.000	-17.633	20.000	22.500	30.000	-1.000	-18.000	-12.494	1D.000	3.000	.800
-127.388	-126.061	-15.175	15.000	19.366	30.000	-3.003	-17.000	-12.494	14.182	4.255	1.135
-113.234	-112.122	-12.717	11.000	16.227	32.000	-3.94	-10.000	-12.494	18.364	5.509	1.469

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JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20  EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE
VALUE 14 4 2 3 2 4 3 4 4 0 1 1 0 1 0 0 0 1 0 4  ALFA= .00 MACHNO= .0000 ALTITUDE=***** 27

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SURFACE # 2 = HORIZONTAL TAILED  
\*\*\*\*\*

SPAN	ROOT CHORD	TIP CHORD	KOUT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
80.000	30.000	20.000	-2.0000	-4.0000	2319.30	3.2000	25.000	25.333	18.667	131.000	-19.337
FLAP SPAN1 .000	FLAP SPAN2 40.000	FLAP SPAN3 -10.000	DEFLEC .000	TAB .000	L.TAIL DEFLEC .000	R.TAIL DEFLEC .000	DIHED. MGC/4 .000	SHEEP MGC/4 10.620	NO.SPAN ELEMENTS 4	NO.CHORD ELEMENTS 3	NO.CHORD DISCONT. 1
FUS STA X(LOC) Y(LG)	WING STA Z(CCG)	WL STA S(CCG)	AREA C(CHG)	CHORD C(CCG)	SPAN B(CCG)						
-40.000 -40.000	-20.000 120.000	130.000 135.000	150.000 -2.000	.000 -10.620	20.000 10.000	3.000 3.000					
-36.000 -36.000	-20.000 124.000	129.000 134.250	150.000 -2.000	.000 -10.620	21.000 10.000	3.000 3.000					
-32.000 -32.000	-20.000 128.000	128.500 132.150	150.000 -2.000	.000 -10.620	22.000 10.000	3.000 3.000					
-28.000 -28.000	-20.000 132.000	132.000 137.000	150.000 -2.000	.000 -10.620	23.000 10.000	3.000 3.000					
-24.000 -24.000	-20.000 136.000	136.000 141.250	150.000 -2.000	.000 -10.620	24.000 10.000	3.000 3.000					
-20.000 -20.000	-20.000 140.000	140.000 146.500	150.000 -2.000	.000 -10.620	25.000 10.000	3.000 3.000					
-16.000 -16.000	-20.000 144.000	144.000 151.000	150.000 -2.000	.000 -10.620	26.000 10.000	3.000 3.000					

WS	Y	Z	X(LOC)	X(LG/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-40.000 -40.000	-20.000 120.000	130.000 135.000	150.000 -2.000	.000 -10.620	20.000 10.000	3.000 3.000					
-36.000 -36.000	-20.000 124.000	129.000 134.250	150.000 -2.000	.000 -10.620	21.000 10.000	3.000 3.000					
-32.000 -32.000	-20.000 128.000	132.500 137.000	150.000 -2.000	.000 -10.620	22.000 10.000	3.000 3.000					
-28.000 -28.000	-20.000 132.000	132.000 137.000	150.000 -2.000	.000 -10.620	23.000 10.000	3.000 3.000					
-24.000 -24.000	-20.000 136.000	136.000 141.250	150.000 -2.000	.000 -10.620	24.000 10.000	3.000 3.000					
-20.000 -20.000	-20.000 140.000	140.000 146.500	150.000 -2.000	.000 -10.620	25.000 10.000	3.000 3.000					
-16.000 -16.000	-20.000 144.000	144.000 151.000	150.000 -2.000	.000 -10.620	26.000 10.000	3.000 3.000					

## 6.2 EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20    EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
 VALUE 14 4 2 3 2 4 3 4 4 6 1 1 0 1 0 0 0 1 0 4    ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 29  
 ROTATION = 1/(1,1) INDICATES A SOLUTION FOR SURFACE # 1 IS OUT  
 CONSIDERING SURFACE # 1 ONLY

LEFT DISTRIBUTION DETAIL-SURFACE NO.= 1/1 4, 11  
\*\*\*\*\*

J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	V1(X)	V1(Y)	V1(Z)	GAMA
1	1	17.771	-130.043	-15.795	61.2737	3.3527	.34119	-.05387	.95913	.00681	.04141	-.17854	-.4900+01
1	2	20.801	-130.043	-15.815	61.2737	1.7490	-.05820	-.15014	.95901	.00755	-.01219	.11125	.2596+01
1	3	23.831	-130.043	-15.836	61.2737	1.3455	.02500	-.16349	.97011	.01244	-.02245	.14417	.2020+01
1	4	27.056	-130.043	-15.673	78.7805	1.4206	-.08275	-.19426	.95939	-.00291	-.05451	.24787	.2750+01
2	1	12.145	-110.130	-12.544	89.4594	3.6325	.36292	-.04957	.96069	.01147	.04791	-.20024	-.7763+01
2	2	16.569	-110.130	-12.500	89.4594	1.8395	-.04658	-.14616	.95622	.00767	-.01218	.12551	.3991+01
2	3	20.994	-110.130	-12.456	89.4594	1.3923	.01126	-.16091	.97176	.01373	-.02528	.15789	.3059+01
2	4	25.685	-110.066	-12.046	115.0192	1.4516	-.09578	-.17580	.95316	-.01031	-.06225	.26009	.4114+01
3	1	6.520	-90.217	-6.490	117.6450	3.6835	.35231	-.04446	.96960	.01832	.05187	-.18846	-.1037+02
3	2	12.338	-90.217	-9.332	117.6450	1.8443	.02797	-.14298	.95842	.00863	-.01114	.14300	.5268+01
3	3	18.156	-90.217	-9.175	117.6450	1.3934	-.00604	-.15867	.97241	.01407	-.02837	.17523	.4023+01
3	4	24.326	-90.133	-8.530	151.2579	1.4599	-.11189	-.17427	.95098	-.01234	-.07074	.27510	.5444+01
4	1	.894	-70.304	-6.631	145.8307	3.6994	.34018	-.03982	.98049	.02646	.05886	-.17482	-.1292+02
4	2	8.106	-70.304	-6.312	145.8307	1.8325	.01275	-.13974	.96273	.01119	-.00709	.15943	.6696+01
4	3	15.318	-70.304	-5.993	145.8307	1.3765	-.02220	-.15653	.97496	.01600	-.02886	.19178	.4930+01
4	4	22.967	-70.200	-5.060	187.4966	1.4587	-.12940	-.17317	.95862	-.01264	-.07727	.29190	.6745+01
5	1	-4.731	-50.391	-3.969	174.0164	3.7010	.31920	-.03878	1.00180	.03905	.08887	-.14914	-.1544+02
5	2	3.875	-50.391	-3.440	174.0164	1.8367	-.00222	-.13817	.97988	.02102	.02520	.17948	-.7777+01
5	3	12.481	-50.391	-2.910	174.0164	1.3647	-.04057	-.15699	.99271	.02916	.00085	.21522	.5837+01
5	4	21.551	-50.237	-1.473	223.7353	1.5111	-.15875	-.18925	.95198	-.00958	-.05840	.32466	.8291+01
6	1	-7.605	-30.327	-2.661	188.4164	2.9548	.19307	-.00159	1.03889	.05375	.05764	-.01928	-.1377+02
6	2	1.713	-30.327	-2.011	188.4164	1.8781	-.05007	-.00323	1.02343	.03848	.03440	.22382	.8753+01
6	3	11.031	-30.327	-1.361	188.4164	1.8211	-.07307	-.00357	1.04030	.05547	.01229	.24676	.8486+01
6	4	20.707	-30.231	-.631	242.2497	2.5312	-.27833	-.02616	.96685	-.01725	-.03472	.45125	.1531+02
7	1	-7.667	-10.110	-2.634	188.7236	3.3638	.24995	.00000	1.03270	.04789	.00121	-.07681	-.1570+02
7	2	1.667	-10.110	-1.981	188.7236	1.9792	-.03493	.00000	1.01830	.03349	-.00633	.20857	.9236+01
7	3	11.000	-10.110	-1.329	188.7236	1.7022	-.06998	.00000	1.04266	.05805	-.00232	.24363	.8317+01

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE
VALUE	14	4	2	3	2	4	3	4	4	6	1	1	0	1	0	0	0	1	0	4	ALFA= 10.00 MACHNO= .2000 ALTITUDE=***** 30
7	4	20.598	-10.110	.871	242.6446	2.5103	-.28709	.00000	.95976	-.02505	-.00408	.46074	-.1506+02								
8	1	-7.667	10.110	-2.634	188.7236	3.0956	.21128	.00000	1.03348	.04867	-.00887	-.03764	-.1445+02								
8	2	1.667	10.110	-1.981	188.7236	1.9130	-.04119	.00000	1.02066	.03586	.01086	.21483	-.8927+01								
8	3	11.000	10.110	-1.329	188.7236	1.7759	-.07342	.00000	1.04517	.06036	.03008	.24707	.8287+01								
8	4	20.598	10.110	.871	242.6447	2.5360	-.28774	.00000	.96247	-.02233	.05741	.46138	-.1522+02								
9	1	-7.605	30.327	-2.661	188.4164	1.7018	.00832	-.00273	1.04643	.06073	-.15159	.16573	-.7931+01								
9	2	1.713	30.327	-2.011	188.4164	1.5863	-.08984	.00343	1.02816	.04292	.09623	.26378	.7393+01								
9	3	11.031	30.327	-1.361	188.4164	1.9069	-.08257	.00356	1.02887	.04394	-.04469	.25636	.8887+01								
9	4	20.812	30.330	-.151	242.2497	2.7306	-.27140	.07493	.97250	-.00857	.05019	.44222	.1630+02								
10	1	-4.731	50.391	-3.969	174.0164	4.1886	.46248	-.00276	.99352	.00629	-.17412	.28819	-.1748+02								
10	2	3.875	50.391	-3.440	174.0164	1.2275	.05866	-.12210	.95762	.01324	.07832	.12412	.5197+01								
10	3	12.481	50.391	-2.910	174.0164	.0575	.01032	-.14506	.96198	.00576	.02547	.16699	.2460+00								
10	4	21.623	50.327	-.2705	223.7354	-1.0120	.08627	-.20403	.96674	-.00579	.00429	.08015	.5598+01								
11	1	.894	70.304	-6.631	145.8307	2.7466	.29936	.04758	.95330	.00598	-.03044	.13597	-.9593+01								
11	2	8.106	70.304	-6.312	145.8307	.9028	.02562	.13365	.94006	-.00739	.02986	.14276	.3200+01								
11	3	15.318	70.304	-5.993	145.8307	.1729	.00992	.14861	.95370	-.00249	.03465	.1537	.6196+00								
11	4	22.906	70.166	-6.432	187.4966	-.0872	.14661	-.14447	.96873	-.00081	.03465	.01952	.3739+01								
12	1	6.520	90.217	-6.490	117.6451	2.2243	.25439	.06858	.94589	.00274	-.01894	.09057	-.6260+01								
12	2	12.338	90.217	-5.332	117.6451	.7000	.03237	.13975	.94368	-.00392	.02380	.13648	.2000+01								
12	3	18.156	90.217	-5.175	117.6451	.0548	.02020	.15283	.95951	.00165	.03383	.14750	.1583+00								
12	4	24.277	90.106	-5.636	151.2579	-.9048	.16038	-.14584	.96804	-.00002	.01263	.00876	.3380+01								
13	1	12.145	110.130	-12.544	89.4594	1.8027	.22442	.08557	.94099	.00103	-.01156	.06041	.3852+01								
13	2	16.569	110.130	-12.500	89.4594	.5268	.04149	.14521	.94626	-.00069	.02140	.12722	.1143+01								
13	3	20.994	110.130	-12.456	89.4594	-.0457	.03258	.15657	.96396	-.00583	.02580	.13597	.1003+00								
13	4	25.648	110.046	-12.888	115.0192	-.9785	.17458	-.14715	.96912	-.00024	.00293	.00416	.2779+01								
14	1	17.771	130.043	-15.795	61.2737	1.4769	.20591	.09940	.93714	.00036	-.00721	-.04189	.2159+01								
14	2	20.801	130.043	-15.815	61.2737	.3655	.05347	.14983	.94730	.00105	.01920	.11496	.5428+00								
14	3	23.831	130.043	-15.836	61.2737	-.1681	.04725	.15941	.96484	.00672	.02022	.12175	.2524+00								
14	4	27.039	130.000	-16.102	78.7805	-.10584	.18867	.13981	.96958	.00095	-.00176	.01755	.2057+01								

SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 1/1 1, 11  
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JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE
VALUE	14	4	2	3	2	4	3	4	4	6	1	1	0	1	0	0	0	1	0	4 <th>ALFA= 10.00 MACHNO= .2000 ALTITUDE=***** 31</th>	ALFA= 10.00 MACHNO= .2000 ALTITUDE=***** 31
1	-.4644	-130.043	-15.805	131.433	1.8747	-.2683	1.8928	.2789	-.1718	.0878	.0830	.1551	-.9844								
2	-.3933	-110.130	-12.522	111.212	1.9819	-.2948	2.0030	.2930	-.1648	.1356	.0961	.1349	-.9862								

2 EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

3	-.3222	-90.217	-9.411	50.992	2.0043	-.2704	2.0207	.3011	-.1616	.1800	.1117	.1208	-.9864
4	-.2511	-70.304	-6.472	70.771	2.0121	-.2422	2.0236	.3073	-.1573	.2234	.1284	.1067	-.9860
5	-.1800	-50.391	-3.704	50.551	2.0607	-.1946	2.0632	.3240	-.1654	.2718	.1599	.1465	-.9762
6	-.1083	-30.327	-2.336	30.331	2.3410	-.1312	2.2827	.4223	-.3828	.3256	.2765	.0260	-.9606
7	-.0361	-10.110	-2.308	10.110	2.4373	-.0652	2.3889	.4346	-.3557	.3413	.2866	.0000	-.9581
8	.0361	10.110	-2.308	10.110	2.3674	-.1151	2.3115	.4311	-.3721	.3302	.2864	.0000	-.9581
9	.1083	30.327	-2.336	30.331	2.0505	-.2890	1.9692	.4063	-.4763	.2809	.2681	-.0740	-.9606
10	.1800	50.391	-3.704	50.551	.9796	-.4496	1.0428	.0920	.3296	.1374	.0870	.2057	.9747
11	.2511	70.304	-6.472	70.771	.6223	-.1647	.6415	.0775	.2238	.0708	.1478	.1459	.9782
12	.3222	90.217	-9.411	90.992	.4004	-.0955	.4109	.0529	.2246	.0366	.1615	.1469	.9759
13	.3933	110.130	-12.522	111.212	.2207	-.0486	.2258	.0299	.2254	.0153	.1753	.1478	.9734
14	.4644	130.043	-15.805	131.433	.0590	-.0140	.0605	.0078	.2332	.0028	.1891	.1401	.9719

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NDS.= 1 - 1

E	FEN	ECX	FCY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	1.6858	-.0753	.0648	1.6733	.2186	-.1030	-.1375	-.0076	5.49	-5.66	8199.59	32.68	280.00
1	.1404*	.1345*	.0037*	.1149*	.1568*	.0243*	-.0094*	.0092*	5.49*	-5.66*	8199.59*	32.68*	280.00*

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
VALUE 14 4 2 3 2 4 3 4 4 6 1 1 0 1 0 0 0 1 0 4 ALFA= 10.00 MACHNO=.2000 ALTITUDE\*\*\*\*\* 32

\*\*\* AIRLOAD SUMS \*\*\*

AC	1.6858	-.0753	.0648	1.6733	.2186	-.1030	-.1375	-.0076	5.49	-5.66	8199.59	32.68	280.00
CG	1.6857	-.0753	.0648	1.6732	.2186	-.3992	-.1388	-.0063	.00	.00	8200.00	32.68	280.00
AC	.1404*	.1345*	.0037*	.1149*	.1568*	.0243*	-.0094*	.0092*	5.49*	-5.66*	8199.59*	32.68*	280.00*
CG	.1404*	.1344*	.0037*	.1149*	.1568*	.0240*	-.0095*	.0093*	.00*	.00*	8200.00*	32.68*	280.00*

\* DETERMINANT= .1721+35 \* SCALE= .4057+02 \*

THE LIFT COEFFICIENT FOR THE WING ALONE, 1/(1,1), IS  $C_L = 1.6732$  WITH L.E. SUCTION (BLUNT L.E.)  
= 1.7801 NO L.E. SUCTION (SHARP L.E.)

NOTATION = 1/(1,2) INDICATES SOLUTION FOR SURFACE # 1 IS OUTPUT  
CONSIDERING SURFACES # 1 AND # 2 SIMULTANEOUSLY.

LIFT DISTRIBUTION DETAIL-SURFACE NO.= 1/(1, 2)

J	K	P(X)	P(Y)	P(Z)	AREA	C PN	G(X)	G(Y)	G(Z)	V(X)	V(Y)	V(Z)	GAMA
1	1	17.771	-130.043	-15.795	61.2737	3.1425	.31837	-.07038	.95354	.00802	.03862	-.15499	-.4593+01
1	2	20.801	-130.043	-15.815	61.2737	1.6534	.05411	-.15123	.95632	.00875	-.01141	.11563	-.2454+01
1	3	23.831	-130.043	-15.836	61.2737	1.2875	.02272	-.16403	.97138	.01353	-.02097	.14675	-.1933+01
1	4	27.056	-130.011	-15.673	78.7805	1.3894	-.08469	-.19473	.96119	-.00124	-.05213	.25029	-.2690+01
2	1	12.145	-110.130	-12.544	89.4594	3.3616	.33326	-.05804	.96127	.01295	.04482	-.16955	-.7184+01
2	2	16.569	-110.130	-12.500	99.4594	1.7175	.03951	-.14761	.95838	.00952	-.01039	.13105	-.3727+01
2	3	20.994	-110.130	-12.456	89.4594	1.3184	.00832	-.16169	.97387	.01546	-.02226	.16141	-.2892+01
2	4	25.685	-110.066	-12.046	115.0192	1.4125	-.09848	-.17652	.95619	-.00756	-.05737	.26371	-.4003+01
3	1	6.520	-90.217	-5.490	117.6450	3.3530	.31851	-.05474	.97087	.02014	.05015	-.15115	-.9436+01
3	2	12.338	-90.217	-5.332	117.6450	1.6965	.02178	-.15486	.96210	.01146	-.00651	.15011	-.4846+01
3	3	18.156	-90.217	-5.175	117.6450	1.3052	-.00967	-.15976	.97597	.01674	-.02159	.18004	-.3769+01
3	4	24.326	-90.133	-8.530	151.2579	1.4156	-.11550	-.17528	.95533	-.00859	-.06081	.28052	-.5278+01
4	1	.894	-70.304	-6.631	145.8307	3.3054	.29793	-.05246	.98561	.02937	.06755	-.12933	-.1155+02
4	2	8.106	-70.304	-6.312	145.8307	1.6595	.00481	-.14261	.97073	.01588	.00967	.17011	-.5882+01
4	3	15.318	-70.304	-.993	145.8307	1.2825	-.02760	-.15839	.98190	.02027	-.00915	.20042	-.4594+01
4	4	22.967	-70.200	-.560	187.4966	1.4233	-.13463	-.17456	.95660	-.00816	-.05378	.30129	-.6581+01
5	1	-4.731	-50.391	-3.969	174.0164	3.0735	.22060	-.07095	1.03529	.05122	.16994	-.03546	.1283+02
5	2	3.875	-50.391	-3.440	174.0164	1.7399	-.02271	-.16665	1.00926	.03140	.11899	.21380	-.7367+01
5	3	12.481	-50.391	-2.910	174.0164	1.3055	-.04723	-.16073	1.01103	.03501	.09099	.23575	-.5969+01
5	4	21.551	-50.237	-1.473	223.7353	1.5714	-.15479	-.19029	.95913	-.00789	.01769	.33482	-.8622+01

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE
VALUE	14	4	2	3	2	4	3	4	4	6	1	1	0	1	0	0	1	0	4	4	ALFA= 10.00 MACHNO=.2000 ALTITUDE***** 33
6	1	-7.605	-30.327	-2.661	198.4164	3.9243	.33613	-.00707	1.03018	.04427	.18413	-.16200	-.1829+02								
6	2	1.713	-30.327	-2.001	198.4164	2.1643	-.02451	-.03039	1.01287	.02735	.15993	.19863	-.1009+02								
6	3	11.031	-30.327	-1.361	198.4164	1.9240	-.06319	-.00352	1.03328	.04810	.12577	.23724	-.8967+01								
6	4	20.707	-30.231	-.631	242.2497	2.5434	-.27064	-.02594	.96082	-.02419	.04952	.44557	-.1538+02								
7	1	-7.667	-10.110	-2.634	198.7236	4.7329	.42732	-.03000	1.02377	.03896	.04678	-.25367	-.2209+02								
7	2	1.667	-10.110	-1.981	198.7236	2.4835	-.00090	.00000	1.00259	.01779	.04444	.17455	-.1159+02								
7	3	11.000	-10.110	-1.329	198.7236	2.0149	-.05192	-.00000	1.03039	.04558	.03885	.22557	-.9399+01								
7	4	20.598	-10.110	-.871	242.6446	2.5658	-.27347	-.00000	.94594	-.03887	.02672	.44712	-.1539+02								
8	1	-7.667	10.110	-2.634	198.7236	4.5395	.40490	-.00000	1.02298	.03818	.04600	-.23126	-.2116+02								
8	2	1.667	10.110	-1.981	198.7236	2.4184	-.00464	.00000	1.00421	.01940	.03917	.17828	-.1129+02								
8	3	11.000	10.110	-1.329	198.7236	1.9977	-.05550	-.00000	1.03261	.04781	.01502	.22915	-.9322+01								
8	4	20.598	10.110	-.871	242.6446	2.5856	-.27536	-.00000	.94899	-.03581	.02470	.44901	-.1551+02								
9	1	-7.605	30.327	-2.661	198.4164	2.4864	+.12055	-.00203	1.04000	.05349	.028414	.05385	-.1159+02								
9	2	1.713	30.327	-2.001	198.4164	1.9337	-.06992	-.00331	1.01926	.03343	.022668	.24423	-.8546+01								
9	3	11.031	30.327	-1.361	198.4164	2.0084	-.07382	-.00351	1.02224	.03695	.016170	.24799	-.9300+01								
9	4	20.812	30.339	-.151	242.2497	2.7493	-.25802	-.07435	.96841	-.01458	.03993	.43522	-.1541+02								
10	1	-4.731	50.391	-3.969	174.0164	3.6302	.37907	-.02497	1.02369	.01616	.25100	-.18991	-.1515+02								
10	2	3.875	50.391	-3.440	174.0164	1.1086	.04230	+.12928	.98401	-.00482	.16684	.15344	-.4604+01								
10	3	12.481	50.391	-2.910	174.0164	.0280	.00593	+.14816	.97827	-.00128	.11083	.18447	-.1199+00								

6.2 EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

10	4	21.623	50.327	-2.705	223.7354	-1.0585	.09538	.20498	.97367	.00802	-0.08489	.09426	.5853+01
11	1	.894	70.304	-6.631	145.8307	2.3284	.25476	.06073	.95726	.00868	-0.03558	-.08850	-.8133+01
11	2	8.106	70.304	-6.312	145.8307	.7175	.01733	.13690	.94737	-.00280	.01597	.15338	-.2543+01
11	3	15.318	70.304	-5.993	145.8307	.0672	.00482	.15045	.96079	.00225	.03417	.16334	-.2408+00
11	4	22.906	70.166	-6.432	187.4966	-.8666	.14342	.14527	.97242	.00329	.01610	.02551	.4014+01
12	1	6.520	90.217	-6.490	117.6651	1.8759	.21660	.07943	.94703	.00463	-.01646	-.05127	-.5279+01
12	2	12.338	90.217	-6.332	117.6651	.5447	.02590	.14172	.94753	-.00087	.01943	.14385	-.1556+01
12	3	18.156	90.217	-6.175	117.6651	-.0391	.01649	.15407	.96388	.00515	.02703	.15239	.1128+00
12	4	24.277	90.106	-6.636	151.2579	-.9576	.15765	.14637	.97117	.00164	.00549	.01269	.3577+01
13	1	12.145	110.130	-12.564	89.4594	1.5216	.19363	.09437	.94162	.00261	-.00829	-.02857	-.3252+01
13	2	16.569	110.130	-12.500	99.4594	.4001	.03624	.14672	.94864	.00139	.01956	.13294	-.8681+00
13	3	20.994	110.130	-12.456	99.4594	-.1229	.02957	.15748	.96681	.00829	.02261	.13959	.2697+00
13	4	25.648	110.046	-12.888	115.0192	-.1.0216	.17225	.14750	.97028	.00071	-.00023	.00127	.2901+01
14	1	17.771	130.043	-15.795	61.2737	1.2612	.18248	.10609	.93761	.00093	-.00436	-.01770	-.1843+01
14	2	20.801	130.043	-15.815	61.2737	.2675	.04927	.15097	.94875	.00238	.01835	.11947	-.3971+00
14	3	23.831	130.043	-15.836	61.2737	-.2280	.04493	.15003	.96654	.00823	.01860	.12440	.3423+00

JDBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
VALUE 14 4 2 3 2 4 3 4 4 0 1 1 0 1 0 0 0 1 0 4 ALFA= 10.00 MACHNO= .2000 ALTITUDE=\*\*\*\*\* 34

J	K	P(X)	P(Y)	P(Z)	AREA	CPA	G(X)	G(Y)	G(Z)	V1(X)	V1(Y)	V1(Z)	GAMA
14	4	27.039	130.000	-16.104	70.7603	-1.0510	.18681	.14006	.97032	-.00030	-.00338	-.01540	.2121+01

LIFT DISTRIBUTION DETAIL-SURFACE NO.= 2/1 1, 2)  
\*\*\*\*\*

J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	V1(X)	V1(Y)	V1(Z)	GAMA
16	1	129.062	-30.000	-19.269	120.0000	-2.0648	-.15909	-.04257	1.01734	.02604	.13977	.33758	.6303+01
16	2	135.312	-30.000	-19.487	120.0000	-1.1296	-.00198	-.00352	1.01865	.02474	.14480	.17611	.3514+01
16	3	142.476	-30.000	-20.064	200.0000	-.9998	.07207	.01089	.95773	.01278	.14485	.10001	.4999+01
17	1	124.687	-10.000	-19.110	170.0000	-2.3959	-.20035	-.05144	.99651	.03078	.02060	.37890	.1024+02
17	2	133.437	-10.000	-19.422	170.0000	-1.2065	-.03572	-.00384	1.00975	.02718	.02335	.17946	.5255+01
17	3	142.462	-9.996	-20.174	200.0000	-1.0489	.08261	-.00000	.99736	.01255	.02330	.09104	.5243+01

JDBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
VALUE 14 4 2 3 2 4 3 4 4 6 1 1 0 1 0 0 0 1 0 4 ALFA= 10.00 MACHNO= .2000 ALTITUDE=\*\*\*\*\* 35

J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	V1(X)	V1(Y)	V1(Z)	GAMA
16	1	129.062	-30.000	-19.269	120.0000	-2.0648	-.15909	-.04257	1.01734	.02604	.13977	.33758	.6303+01
16	2	135.312	-30.000	-19.487	120.0000	-1.1296	-.00198	-.00352	1.01865	.02474	.14480	.17611	.3514+01
16	3	142.476	-30.000	-20.064	200.0000	-.9998	.07207	.01089	.95773	.01278	.14485	.10001	.4999+01
17	1	124.687	-10.000	-19.110	170.0000	-2.3959	-.20035	-.05144	.99651	.03078	.02060	.37890	.1024+02
17	2	133.437	-10.000	-19.422	170.0000	-1.2065	-.03572	-.00384	1.00975	.02718	.02335	.17946	.5255+01
17	3	142.462	-9.996	-20.174	200.0000	-1.0489	.08261	-.00000	.99736	.01255	.02330	.09104	.5243+01

SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 2/1 1, 2)  
\*\*\*\*\*

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	IXL	LYL	I2L
16	-3750	-30.000	-19.378	311.563	-1.3465	-.0598	-1.3157	-.2442	.1100	-.3700	.0720	.0109	.9973
17	-1250	-10.000	-19.269	291.563	-1.5277	-.1234	-1.4831	-.2867	.1088	-.5098	.0825	-.0000	.9966
18	-1250	10.000	-19.269	291.563	-1.5890	-.1398	-1.5406	-.3002	.1024	-.5296	.0806	-.0000	.9967
19	.3750	30.000	-19.378	311.563	-1.2446	-.0397	-1.2188	-.2230	.1079	-.3428	.0676	-.0109	.9977

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS.= 1 - 2  
\*\*\*\*\*

E	ECN	ECX	ECY	ECL	ECD	ECM	ECMY	EXA	EZA	FS	EMGC	EB	
1	1.7593	-.1156	.0667	1.7526	.1917	-.0474	-.1396	-.0077	5.49	-.56	8199.59	32.68	280.00
1	-.1401*	.1362*	.0029*	.1143*	.1585*	.0292*	-.0091*	.0085*	5.49*	-.56	8199.59*	32.68*	280.00*
2	-1.4401	-.0948	-.0002	-1.4018	-.13434	.1023	.0065	-.0012	131.00	-.19.34	2000.00	25.33	80.00
2	-.0977*	.0948*	.0000*	-.1127*	.0764*	-.0257*	-.0012*	.0012*	131.00*	-.19.34*	2000.00*	25.33*	80.00*

JDBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
VALUE 14 4 2 3 2 4 3 4 4 6 1 1 0 1 0 0 0 1 0 4 ALFA= 10.00 MACHNO= .2000 ALTITUDE=\*\*\*\*\* 36

\*\*\* AIRLOAD SUMS \*\*\*

AC	1.4080	-.1387	.0667	1.4107	.1079	1.3113	-.1391	-.0078	5.49	-.56	8199.59	32.68	280.00
CG	1.4080	-.1387	.0667	1.4107	.1079	1.0508	-.1405	-.0065	.00	.00	8200.00	32.68	280.00
AC	.1163*	.1593*	.0029*	.0868*	.1771*	.1255*	-.0090*	.0090*	5.49*	-.56	8199.59*	32.68*	280.00*
CG	.1163*	.1593*	.0029*	.0868*	.1771*	.1336*	-.0091*	.0090*	.00*	.00*	8200.00*	32.68	280.00*

\* DETERMINANT= .2376+13 \* SCALE= .3941-02 \*

END OF XQT NSURE \*\*\*\* JOB TIME= 68 / ELAPSED TIME= 79 / NO.PLOT FILES= 7 / NSURF EXEC. VERSION 6-18-72 \*\*\*\*

5.2 EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

XQT TRWPLT

```

KUNIT = 8
ICCMNP = 0
NTRAN = 0
IPRINT = 0
NTYPE = 0
NDFSL = 1
ISCALY = 1,1,1,1,1,1,1,1,1,1
NXL = 24
NJR = 24
NYL = 24
NYH = 24
NPOSN1 = 600, 950
NPOSN2 = 600, 925
NPOSN3 = 600, 900
NPOSN4 = 600, 50
ANNDT1 = 10 = EXAMPLE PROB. 1 - MULTIPLE-SURFACE
ANNDT2 = 10 = CAPABILITY DEMONSTRATION RUN
ANNDT3 = 10 =
ANNDT4 = 10 =
CHARSZ = 1.0,1.0,1.0,1.0
TITLE = 10 = ISOMETRIC PROJECTION OF LIFTING SURFACES
XLABEL = 10 = HORIZONTAL AXIS, SEMISPANS
YLABEL = 10 = VERTICAL AXIS SEMISPANS
XHI = 1.5
XLO=-1.0
YHI = 1.5
YLO=-1.0
PLOT = 2,1, 3,1, ENULST
ENDPLT
ANOTSV = 0
NOADV = 1
PLOT = 5,1, 6,1, ENULST
ENDPLT
NOADV = 1
PLOT = 2,2, 3,2, ENULST
ENDPLT
NOADV = 1
PLOT = 2,3, 3,3, ENULST
ENDPLT
ENDFIL

```

MICROFILM PLOT COMPLETED

```

NOADV = 1
PLOT = 2,1, 3,1, ENULST
ENDPLT
NOADV = 1
PLOT = 5,1, 6,1, ENULST
ENDPLT
NOADV = 1
PLOT = 2,2, 3,2, ENULST
ENDPLT
NOADV = 1
PLOT = 2,3, 3,3, ENULST
ENDPLT
ENDFIL

```

MICROFILM PLOT COMPLETED

```

NOADV = 1
PLOT = 2,1, 3,1, ENULST
ENDPLT
NOADV = 1
PLOT = 5,1, 6,1, ENULST
ENDPLT
NOADV = 1
PLOT = 2,2, 3,2, ENULST
ENDPLT
NOADV = 1
PLOT = 2,3, 3,3, ENULST
ENDPLT
ENDFIL

```

MICROFILM PLOT COMPLETED

```

NOADV = 1
PLOT = 2,1, 3,1, ENULST
ENDPLT
NOADV = 1
PLOT = 5,1, 6,1, ENULST
ENDPLT
NOADV = 1
PLOT = 2,2, 3,2, ENULST
ENDPLT
NOADV = 1

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NOADV = 1
PLOT = 2,3, 3,3, ENULST
ENDPLT
ENDFIL

```

SOME OF THE OUTPUT OMITTED, SEE INPUT-DATA LISTING ON PAGES 6-1 AND 6-2.

MICROFILM PLCT COMPLETED

```

NOADV = 1
PLOT = 2,1, 3,1, ENULST
ENDPLT
NOADV = 1
PLOT = 5,1, 6,1, ENULST
ENDPLT
NOADV = 1
PLOT = 2,2, 3,2, ENULST
ENDPLT
NOADV = 1
PLOT = 2,3, 3,3, ENULST
ENDPLT
ENDFIL

```

MICROFILM PLCT COMPLETED  
ENDRUN

ORIGINAL PAGE IS  
OF POOR QUALITY

### 6.3 EXAMPLE PROBLEM # 2, SINGLE-SURFACE ANALYSIS CAPABILITY

SUBSONIC-FLOW LIFTING SURFACE ANALYSIS PROGRAM HA010B  
TRW SYSTEMS INC., HOUSTON OPERATIONS  
HOUSTON, TEXAS {77058}

\*\*\*\* JOBS INPUT LIST \*\*\*\*

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T XUT ISURF
EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION
TASK 702, PROJECT 3303A, MJD 147033, AERODYNAMIC ANALYSIS AND DESIGN
SUBSONIC-FLOW LIFTING SURFACE ANALYSIS, TRW PROGRAM NO. HA010B (ISURF)
A.V.GOMEZ 5 JULY 1972

$INPUT
NSS=2, NCS=2, IFLG(2)=0,16,0, IFLG(5)=1,4,0, IFLG(8)=1, IFLG(10)=5,
X=2*%, Y=0.0,30.0, Z=2*0.0, E=2*0.0, L=12.0,5.0, XCCR=0.25, XOC=0.0,1.0,
WF LAP1=0., WF LAP2=0.625, WF LAP3=1.0, FLAPC=0.25, WSNOTH=0.25,
PMECF=L, LDRAG=1, CLEANF=0.0035, NJOB=1, MATHN=0.2, ALFA=5, DELALF=-12,
FLAPDJ=30.0, ALDQJ=10.0,-15.0,
KT2=6, IFLG(11)=4*1,
NJUBL=9, WCL=1, 0.,0.25,0.5,0.75,1.0,1.25,1.5,1.75,2.0,
SEND
$ENDJOBS
7 XUT ISURF
```

---

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000
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### .3 EXAMPLE PROBLEM # 2, SINGLE SURFACE ANALYSIS CAPABILITY (CONTINUED)

JOBFLAG 1 2 3 4 5 6 7 8 9 LU EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE

HING GEOMETRY

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPL PROBLM NO. 2 - SINGLE SURFACE ANALYSES CAPABILITY DEMONSTRATION PAGE  
VALUE 1 0 16 7 1 4 0 1 0 4 ALFA\*\*\*\*\* MACHNUC .0000 FL4PD= .00 AILEROND= .00 .00 ALTITUDE\*\*\*\*\* 3

J	K	Y	DY	DC	DS
1	1	-2.813 $\pm$ 0.1	3.750 $\pm$ 0.1	1.496 $\pm$ 0.1	2.242 $\pm$ 0.1
2	1	-2.437 $\pm$ 0.1	3.750 $\pm$ 0.1	1.719 $\pm$ 0.1	1.644 $\pm$ 0.1
3	1	-2.626 $\pm$ 0.1	3.750 $\pm$ 0.1	2.331 $\pm$ 0.1	7.611 $\pm$ 0.1
4	1	-1.687 $\pm$ 0.1	3.750 $\pm$ 0.0	2.344 $\pm$ 0.0	0.709 $\pm$ 0.1
5	1	-1.312 $\pm$ 0.1	3.750 $\pm$ 0.0	2.565 $\pm$ 0.0	0.949 $\pm$ 0.1
6	1	-9.375 $\pm$ 0.0	3.750 $\pm$ 0.0	2.969 $\pm$ 0.0	1.111 $\pm$ 0.0
7	1	-5.625 $\pm$ 0.0	3.750 $\pm$ 0.0	3.281 $\pm$ 0.0	1.123 $\pm$ 0.0
8	1	-1.875 $\pm$ 0.0	3.750 $\pm$ 0.0	3.594 $\pm$ 0.0	1.294 $\pm$ 0.0
9	1	1.875 $\pm$ 0.0	3.750 $\pm$ 0.0	3.594 $\pm$ 0.0	1.340 $\pm$ 0.0
10	1	5.625 $\pm$ 0.0	3.750 $\pm$ 0.0	3.281 $\pm$ 0.0	1.123 $\pm$ 0.0
11	1	9.375 $\pm$ 0.0	3.750 $\pm$ 0.0	2.969 $\pm$ 0.0	1.111 $\pm$ 0.0
12	1	1.312 $\pm$ 0.1	3.750 $\pm$ 0.0	2.656 $\pm$ 0.0	0.949 $\pm$ 0.1
13	1	1.687 $\pm$ 0.1	3.750 $\pm$ 0.0	2.344 $\pm$ 0.0	0.709 $\pm$ 0.1
14	1	2.626 $\pm$ 0.1	3.750 $\pm$ 0.0	2.331 $\pm$ 0.0	7.611 $\pm$ 0.1
15	1	2.437 $\pm$ 0.1	3.750 $\pm$ 0.0	1.719 $\pm$ 0.0	1.644 $\pm$ 0.1
16	1	2.813 $\pm$ 0.1	3.750 $\pm$ 0.0	1.496 $\pm$ 0.0	2.242 $\pm$ 0.1

ORIGINAL PAGE IS  
OF POOR QUALITY

6.3 EXAMPLE PROBLEM # 2, SINGLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

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1 2 -2.813+01 3.750+00 1.406+00 5.273+00
2 2 -2.437+01 3.750+00 1.719+00 6.445+00
3 2 -2.062+01 3.750+00 2.031+00 7.017+00
4 2 -1.687+01 3.750+00 2.344+00 8.704+00
5 2 -1.312+01 3.750+00 2.656+00 9.501+00
6 2 -9.375+00 3.750+00 2.969+00 1.113+01
7 2 -5.625+00 3.750+00 3.281+00 1.250+01
8 2 -1.875+00 3.750+00 3.594+00 1.340+01
9 2 1.875+00 3.750+00 3.594+00 1.340+01
10 2 5.625+00 3.750+00 3.281+00 1.250+01
11 2 9.375+00 3.750+00 2.969+00 1.113+01
12 2 1.312+01 3.750+00 2.656+00 9.501+00
13 2 1.687+01 3.750+00 2.344+00 8.704+00
14 2 2.062+01 3.750+00 2.031+00 7.017+00
15 2 2.437+01 3.750+00 1.719+00 6.445+00
16 2 2.813+01 3.750+00 1.406+00 5.273+00

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JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE
VALUE 1 0 10 0 1 4 0 1 0 4 ALTF=***** FACHNO= .0000 FLAPO= .00 AILEROND= .00 ALTITUDE=***** 4

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J	K	Y	BY	OC	US
15	3	2.437+01	3.750+00	1.719+00	6.445+00
16	3	2.813+01	3.750+00	1.406+00	5.273+00
1	4	-2.813+01	3.750+00	1.406+00	5.273+00
2	4	-2.437+01	3.750+00	1.719+00	6.445+00
3	4	-2.062+01	3.750+00	2.031+00	7.017+00
4	4	-1.687+01	3.750+00	2.344+00	8.704+00
5	4	-1.312+01	3.750+00	2.656+00	9.501+00
6	3	-9.375+00	3.750+00	2.969+00	1.113+01
7	3	-5.625+00	3.750+00	3.281+00	1.250+01
8	3	-1.875+00	3.750+00	3.594+00	1.340+01
9	3	1.875+00	3.750+00	3.594+00	1.340+01
10	3	5.625+00	3.750+00	3.281+00	1.250+01
11	3	9.375+00	3.750+00	2.969+00	1.113+01
12	3	1.312+01	3.750+00	2.656+00	9.501+00
13	3	1.687+01	3.750+00	2.344+00	8.704+00
14	2	2.062+01	3.750+00	2.031+00	7.017+00
15	2	2.437+01	3.750+00	1.719+00	6.445+00
16	2	2.813+01	3.750+00	1.406+00	5.273+00

J	K	XV	YY	ZV	1XV	1YY	1ZV	XN	YN	ZN	1XN	1YN	1ZN
1	1	-9.375-01	-3.000+01	0.000	-0.230-02	9.981-01	0.000	-3.516-01	-2.813+01	0.000	0.000	0.000	1.000+00
2	1	-1.172+00	-2.425+01	0.000	-0.230-02	9.981-01	0.000	-4.297-01	-2.437+01	0.000	0.000	0.000	1.000+00
3	1	-1.406+00	-2.250+01	0.000	-0.230-02	9.981-01	0.000	-5.078-01	-2.062+01	0.000	0.000	0.000	1.000+00
4	1	-1.641+00	-1.875+01	0.000	-0.230-02	9.981-01	0.000	-5.859-01	-1.687+01	0.000	0.000	0.000	1.000+00
5	1	-1.875+00	-1.500+01	0.000	-0.230-02	9.981-01	0.000	-6.641-01	-1.312+01	0.000	0.000	0.000	1.000+00
6	1	-2.109+00	-1.125+01	0.000	-0.230-02	9.981-01	0.000	-7.422-01	-9.375+00	0.000	0.000	0.000	1.000+00
7	1	-2.344+00	-7.500+00	0.000	-0.230-02	9.981-01	0.000	-8.203-01	-5.625+00	0.000	0.000	0.000	1.000+00
8	1	-2.578+00	-3.750+00	0.000	-0.230-02	9.981-01	0.000	-8.984-01	-1.075+00	0.000	0.000	0.000	1.000+00
9	1	-2.813+00	0.750	0.000	-0.230-02	9.981-01	0.000	-8.984-01	1.875+00	0.000	0.000	0.000	1.000+00
10	1	-2.578+00	3.750+00	0.000	-0.230-02	9.981-01	0.000	-8.293-01	5.625+00	0.000	0.000	0.000	1.000+00
11	1	-2.344+00	7.500+00	0.000	-0.230-02	9.981-01	0.000	-7.422-01	9.375+00	0.000	0.000	0.000	1.000+00
12	1	-2.109+00	1.250+01	0.000	-0.230-02	9.981-01	0.000	-6.641-01	1.312+01	0.000	0.000	0.000	1.000+00
13	1	-1.875+00	1.500+01	0.000	-0.230-02	9.981-01	0.000	-5.859-01	1.687+01	0.000	0.000	0.000	1.000+00
14	1	-1.641+00	1.875+01	0.000	-0.230-02	9.981-01	0.000	-5.078-01	2.062+01	0.000	0.000	0.000	1.000+00
15	1	-1.406+00	2.250+01	0.000	-0.230-02	9.981-01	0.000	-4.297-01	2.437+01	0.000	0.000	0.000	1.000+00
16	1	-1.172+00	2.625+01	0.000	-0.230-02	9.981-01	0.000	-3.516-01	2.813+01	0.000	0.000	0.000	1.000+00

J	K	XY	YY	ZV	1XY	1YY	1ZV	XN	YN	ZN	1XN	1YN	1ZN
11	2	1.813-01	1.500+00	0.000	-2.083-02	9.998-01	0.000	2.227+00	9.375+00	0.000	0.000	0.000	1.000+00
12	2	7.031-01	1.125+01	0.000	-2.083-02	9.998-01	0.000	1.992+00	1.312+01	0.000	0.000	0.000	1.000+00
13	2	6.250-01	1.500+01	0.000	-2.083-02	9.998-01	0.000	1.758+00	1.687+01	0.000	0.000	0.000	1.000+00
14	2	5.469-01	1.875+01	0.000	-2.083-02	9.998-01	0.000	1.523+00	2.062+01	0.000	0.000	0.000	1.000+00
15	2	4.688-01	2.250+01	0.000	-2.083-02	9.998-01	0.000	1.952+00	2.437+01	0.000	0.000	0.000	1.000+00
16	2	3.906-01	2.625+01	0.000	-2.083-02	9.998-01	0.000	2.227+00	9.375+00	0.000	0.000	0.000	1.000+00

J	K	XY	YY	ZV	1XY	1YY	1ZV	XN	YN	ZN	1XN	1YN	1ZN
11	2	1.813-01	1.500+00	0.000	-2.083-02	9.998-01	0.000	2.227+00	9.375+00	0.000	0.000	0.000	1.000+00
12	2	7.031-01	1.125+01	0.000	-2.083-02	9.998-01	0.000	1.992+00	1.312+01	0.000	0.000	0.000	1.000+00
13	2	6.250-01	1.500+01	0.000	-2.083-02	9.998-01	0.000	1.758+00	1.687+01	0.000	0.000	0.000	1.000+00
14	2	5.469-01	1.875+01	0.000	-2.083-02	9.998-01	0.000	1.523+00	2.062+01	0.000	0.000	0.000	1.000+00
15	2	4.688-01	2.250+01	0.000	-2.083-02	9.998-01	0.000	1.952+00	2.437+01	0.000	0.000	0.000	1.000+00
16	2	3.906-01	2.625+01	0.000	-2.083-02	9.998-01	0.000	2.227+00	9.375+00	0.000	0.000	0.000	1.000+00
1	3	1.563+00	-3.000+01	0.000	-0.003-02	9.998-01	0.000	2.461+00	-2.813+01	0.000	0.000	0.000	1.000+00
2	3	1.953+00	-2.625+01	0.000	-0.003-02	9.998-01	0.000	3.008+00	-2.437+01	0.000	0.000	0.000	1.000+00
3	3	2.344+00	-2.250+01	0.000	-0.003-02	9.998-01	0.000	3.555+00	-2.062+01	0.000	0.000	0.000	1.000+00
4	3	2.734+00	-1.875+01	0.000	-0.003-02	9.998-01	0.000	4.112+00	-1.687+01	0.000	0.000	0.000	1.000+00
5	3	3.125+00	-1.500+01	0.000	-0.003-02	9.998-01	0.000	4.648+00	-1.312+01	0.000	0.000	0.000	1.000+00
6	3	3.516+00	-1.125+01	0.000	-0.003-02	9.998-01	0.000	5.195+00	-9.375+00	0.000	0.000	0.000	1.000+00
7	3	3.906+00	-7.500+00	0.000	-0.003-02	9.998-01	0.000	5.742+00	-5.625+00	0.000	0.000	0.000	1.000+00
8	3	4.297+00	-3.750+00	0.000	-0.003-02	9.998-01	0.000	6.289+00	-1.875+00	0.000	0.000	0.000	1.000+00
9	3	4.688+00	0.000	0.000	-0.003-02	9.998-01	0.000	6.289+00	1.875+00	0.000	0.000	0.000	1.000+00
10	3	4.297+00	3.750+00	0.000	-0.003-02	9.998-01	0.000	5.742+00	5.625+00	0.000	0.000	0.000	1.000+00
11	3	3.906+00	7.500+00	0.000	-0.003-02	9.998-01	0.000	5.195+00	9.375+00	0.000	0.000	0.000	1.000+00
12	3	3.516+00	1.125+01	0.000	-0.003-02	9.998-01	0.000	4.648+00	1.312+01	0.000	0.000	0.000	1.000+00
13	3	3.125+00	1.500+01	0.000	-0.003-02	9.998-01	0.000	4.112+00	1.687+01	0.000	0.000	0.000	1.000+00
14	3	2.734+00	1.875+01	0.000	-0.003-02	9.998-01	0.000	3.555+00	2.062+01	0.000	0.000	0.000	1.000+00
15	3	2.344+00	2.250+01	0.000	-0.003-02	9.998-01	0.000	3.008+00	2.437+01	0.000	0.000	0.000	1.000+00
16	3	1.953+00	2.625+01	0.000	-0.003-02	9.998-01	0.000	2.461+00	2.813+01	0.000	0.000	0.000	1.000+00

### 6.3 EXAMPLE PROBLEM # 2, SINGLE SURFACE ANALYSIS CAPABILITY (CONTINUED)

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1 4 2.813+00 -3.000+01 0.000 1.043+01 9.829-01 0.000 3.867+00 -2.813+01 0.000 0.000 0.000 1.000+00
2 4 3.516+00 -2.625+01 0.000 1.043+01 9.829-01 0.000 4.727+00 -2.437+01 0.000 0.000 0.000 1.000+00
3 4 4.219+00 -2.250+01 0.000 1.043+01 9.829-01 0.000 5.586+00 -2.062+01 0.000 0.000 0.000 1.000+00
4 4 4.924+00 -1.875+01 0.000 1.043+01 9.829-01 0.000 6.445+00 -1.687+01 0.000 0.000 0.000 1.000+00
5 4 5.625+00 -1.500+01 0.000 1.043+01 9.829-01 0.000 7.305+00 -1.312+01 0.000 0.000 0.000 1.000+00
6 4 6.328+00 -1.125+01 0.000 1.043+01 9.829-01 0.000 8.164+00 -9.375+00 0.000 0.000 0.000 1.000+00
7 4 7.031+00 -7.500+00 0.000 1.043+01 9.829-01 0.000 9.023+00 -5.625+00 0.000 0.000 0.000 1.000+00
8 4 7.734+00 -3.150+00 0.000 1.043+01 9.829-01 0.000 9.883+00 -1.875+00 0.000 0.000 0.000 1.000+00
9 4 8.438+00 2.150+00 0.000 1.043+01 9.829-01 0.000 9.883+00 1.875+00 0.000 0.000 0.000 1.000+00
10 4 7.734+00 3.150+00 0.000 1.043+01 9.829-01 0.000 9.023+00 5.625+00 0.000 0.000 0.000 1.000+00
11 4 7.731+00 7.500+00 0.000 1.043+01 9.829-01 0.000 8.164+00 9.375+00 0.000 0.000 0.000 1.000+00
12 4 6.328+00 1.125+01 0.000 1.043+01 9.829-01 0.000 7.305+00 1.312+01 0.000 0.000 0.000 1.000+00
13 4 5.625+00 1.500+01 0.000 1.043+01 9.829-01 0.000 6.445+00 1.687+01 0.000 0.000 0.000 1.000+00
14 4 4.924+00 1.875+01 0.000 1.043+01 9.829-01 0.000 5.586+00 2.362+01 0.000 0.000 0.000 1.000+00
15 4 4.219+00 2.250+01 0.000 1.043+01 9.829-01 0.000 4.727+00 2.437+01 0.000 0.000 0.000 1.000+00
16 4 3.516+00 2.625+01 0.000 1.043+01 9.829-01 0.000 3.867+00 2.813+01 0.000 0.000 0.000 1.000+00

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(EOF PLOT FILE L1 FILE # 1 = PLANFORM AND ISOMETRIC PROJECTION OF WING GEOMETRY

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE  
VALUE 1 0 16 0 1 4 0 1 0 4 ALFA= 3.00 MACHNU= .2000 FLAPD= 30.00 AILEROND= 10.00-15.00 ALTITUDE=\*\*\*\*\* 6

#### LIFT DISTRIBUTION DETAIL \*\*\*\*\*

J	K	P(X)	P(Y)	P(Z)	AREA	CPA	G(X)	G(Y)	G(Z)	V1(X)	V1(Y)	V1(Z)	GAMA
1	1	-1.055	-28.125	.000	2.215+04	1.327d	.10852	.01178	.99082	-.00340	-.00680	-.10174	.9404+00
1	2	.352	-28.125	.000	2.215+04	.3212	.02974	-.00083	.99334	-.00271	-.00383	.04741	-.2273+00
1	3	1.758	-28.125	.000	2.215+04	-.0919	.03029	-.00315	.99150	-.00017	-.00811	.05670	.6482-01
1	4	3.155	-28.125	-.076	2.215+04	-.6745	.01748	.02804	.97868	-.00176	-.00830	-.02180	.4762+00
2	1	-1.289	-24.375	.000	0.449+03	1.9113	.27112	.01694	.98863	-.00664	-.00645	-.18449	.1658+01
2	2	.437	-24.375	.000	0.449+03	.4738	.05538	-.00115	.99792	-.00558	-.00127	.03176	.4108+00
2	3	2.148	-24.375	.000	0.449+03	-.0975	.04919	-.00419	.99102	-.00091	-.01554	.04675	.8413-01
2	4	3.853	-24.375	-.111	0.449+03	-.8292	.12703	.02447	.97830	-.00214	-.00716	-.04174	.7159+00
3	1	-1.523	-20.625	.000	7.017d	2.7622	.41890	.02618	.98731	-.01063	-.05067	-.33256	-.2836+01
3	2	.508	-20.625	.000	7.017d	.6154	.07346	-.00153	.98927	-.00588	-.03973	.01368	.6317+00
3	3	2.539	-20.625	.000	7.017d	-.0922	.02438	-.00254	.98661	-.00223	.01929	.06264	.9435-01
3	4	4.565	-20.625	-.074	7.017d	-.5961	.05499	-.00506	.97736	-.00350	.03133	.6284+00	
4	1	-1.758	-16.875	.000	0.709+04	1.0438	.03108	.00194	1.00015	-.00983	.00152	.05601	-.1210+01
4	2	.586	-16.875	.000	0.709+04	1.0541	-.00785	.00016	1.00239	-.00762	.00801	.09501	-.1232+01
4	3	2.931	-16.875	.000	0.709+04	1.2399	-.00179	.00075	1.00092	-.01391	.03621	.09439	-.1444+01
4	4	5.225	-16.875	.233	0.709+04	1.7377	-.14609	-.00182	.97910	-.00308	-.02711	.23280	-.2084+01
5	1	-1.992	-13.125	.000	9.900+03	1.4015	.08811	.00551	1.00628	-.00940	.004241	-.00113	-.1846+01
5	2	.664	-13.125	.000	9.900+03	1.4330	-.02355	.00077	1.00674	-.01129	.02523	.00770	-.1508+01
5	3	3.320	-13.125	.000	9.900+03	1.3289	.02216	.01754	1.01754	-.02737	.00497	.10843	-.1725+01
5	4	5.888	-13.125	.332	9.900+03	2.1637	-.21901	-.05619	.97864	-.00911	.05307	.30570	-.2086+01
6	1	-2.227	-6.375	.000	11.125+04	1.6506	.13076	.00817	1.00433	-.00822	.02996	-.04386	-.2435+01
6	2	.742	-6.375	.000	11.125+04	1.1634	.05065	-.00012	1.00690	-.01128	.01716	.08151	-.1715+01
6	3	3.711	-6.375	.000	11.125+04	1.2685	-.02104	.00219	1.01875	-.02820	.00125	.10830	-.1838+01
6	4	6.580	-6.375	.371	11.125+04	2.1333	-.05500	.097573	-.01001	-.00935	.31192	-.3190+01	
7	1	-2.461	-5.625	.000	12.304+04	1.6194	.12925	.00808	1.00669	-.00840	.03291	-.04234	-.2639+01
7	2	.820	-5.625	.000	12.304+04	1.1461	.00319	-.00007	1.00723	-.01175	.02384	.08396	-.1866+01
7	3	4.102	-5.625	.000	12.304+04	1.2550	-.12213	.00233	1.01816	-.02870	.01185	.10940	-.2013+01
7	4	7.273	-5.625	.410	12.304+04	2.1351	-.22167	-.05523	.97304	-.00957	-.02077	.31074	-.3538+01
8	1	-2.695	-1.875	.000	12.476+04	1.3190	.06572	.00411	1.00225	-.01089	.01800	.02131	-.2352+01
8	2	.898	-1.875	.000	12.476+04	1.1612	-.00027	.00001	1.00834	-.01265	.01376	.08688	-.2069+01
8	3	4.492	-1.875	.000	12.476+04	1.3462	-.01313	.00127	1.01972	-.02985	.00782	.10936	-.2324+01
8	4	7.966	-1.875	.447	12.476+04	2.1701	-.21373	-.05659	.97380	-.00857	.30381	-.3937+01	
9	1	-2.695	1.875	.000	12.476+04	1.3423	.06910	-.00432	1.00668	-.01081	.021657	.11792	-.2393+01
9	2	.898	1.875	.000	12.476+04	1.1603	-.00079	.00032	1.00824	-.01257	.01450	.08637	-.2083+01
9	3	4.492	1.875	.000	12.476+04	1.3301	-.01294	-.00135	1.01933	-.02978	.00983	.10017	-.2332+01
9	4	7.966	1.875	.447	12.476+04	2.1674	-.21245	-.05662	.97198	-.00701	.007163	.30346	-.3939+01

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE  
VALUE 1 0 16 0 1 4 0 1 0 4 ALFA= 3.00 MACHNU= .2000 FLAPD= 30.00 AILEROND= 10.00-15.00 ALTITUDE=\*\*\*\*\* 7

J	K	P(X)	P(Y)	P(Z)	AREA	CPA	G(X)	G(Y)	G(Z)	V1(X)	V1(Y)	V1(Z)	GAMA
10	1	-2.401	5.625	.000	12.304+04	1.717d	.14560	-.00879	1.00433	-.00811	-.03168	-.05372	-.2773+01
10	2	.820	5.625	.000	12.304+04	1.1727	.00497	-.00010	1.00692	-.01146	.02492	.08219	-.1910+01
10	3	4.102	5.625	.000	12.304+04	1.2071	-.02129	-.00222	1.01754	-.02764	-.01537	.10856	-.2032+01
10	4	7.273	5.625	.410	12.304+04	2.1325	-.21944	-.05536	.97362	-.01121	.00951	.30953	-.3543+01
11	1	-2.227	9.375	.000	11.125+04	1.831d	.15552	-.00972	1.00361	-.00758	-.02875	-.06867	-.2703+01
11	2	.742	9.375	.000	11.125+04	1.2167	.01006	-.00721	1.00622	-.01063	.01896	.17709	-.1795+01
11	3	3.711	9.375	.000	11.125+04	1.2826	-.01862	-.00194	1.01768	-.02764	-.00625	.10588	-.1861+01
11	4	6.580	9.375	.371	11.125+04	2.1270	-.22111	-.05524	.97216	-.01122	.02541	.30974	-.3193+01
12	1	-1.992	13.125	.000	9.900+03	1.8084	.16088	-.00318	1.00410	-.00775	.03380	-.00011	-.2385+01
12	2	.664	13.125	.000	9.900+03	1.2365	-.00017	1.00573	-.01722	.02138	.07922	-.1635+01	
12	3	3.320	13.125	.000	9.900+03	1.3232	-.01734	-.00181	1.01693	-.02686	-.00597	.10459	-.1719+01
12	4	5.888	13.125	.332	9.900+03	2.1412	-.21817	-.05564	.97340	-.011152	.03502	.30577	-.2972+01
13	1	-1.523	16.875	.000	9.091	1.736d	.13505	-.00844	1.00483	-.00730	-.02868	-.24810	-.2522+01
13	2	.580	16.875	.000	9.091	1.2167	.03794	-.00017	1.00315	-.00796	-.03768	.07921	-.1421+01
13	3	2.931	16.875	.000	9.091	1.2827	-.01102	-.00115	1.00827	-.01976	-.02143	.09324	-.1482+01
13	4	5.279	16.875	.267	9.091	1.963d	-.18703	-.07143	.97411	-.03921	.03279	.27465	-.2321+01
14	1	-1.523	20.625	.000	7.017d	2.435d	.29150	-.01822	.99539	-.00146	.00161	.21491	-.2400+01
14	2	.578	20.625	.000	7.017d	1.0377	.04128	-.00786	.99649	-.00109	.002183	.04580	-.1957+01
14	3	2.539	20.625	.000	7.017d	.47203	.01196	-.00020	.99594	-.002658	.01385	.10519	-.7362+01
14	4	4.557	20.625	.114	7.017d	1.979d	-.09707	-.05254	.97774	-.00552	.02029	.18449	-.1001+01
15	1	-1.209	24.375	.000	0.449+03	2.0224	.22491	-.01406	.99512	-.003005	-.01467	.13819	-.1743+01
15	2	.430	24.375	.000	0.449+03	.9447	.03329	-.00694	.99626	-.00038	-.00487	.05386	-.0149+00

6.3 EXAMPLE PROBLEM # 2, SINGLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

15 3	2.148	24.375	.000	0.4455	.6917	.00864	.00090	.99439	.00294	.00605	.07847	- .5946+00
15 4	3.861	24.375	.073	0.4455	.8318	- .06429	.02005	.98029	- .00353	.02554	.15173	- .7167+00
16 1	-1.055	28.125	.000	5.2734	1.4994	.15883	- .00993	.99632	.00125	.01310	.07198	- .1056+01
16 2	.352	28.125	.000	5.2734	.7532	.02289	.00048	.99731	.00140	.00333	.06426	- .5309+00
16 3	1.758	28.125	.000	5.2734	.5929	.01547	.00057	.99454	.00297	.09725	.08165	- .4169+00
16 4	3.160	28.125	.052	5.2734	.7185	- .05405	.02202	.98285	- .00088	.02528	.14133	- .5052+00

SECTION LIFT COEFFICIENTS  
\*\*\*\*\*

J	ZY/B	Y	C	SCL	SCLC/B	DLIFT	SCMC(4)	IXL	YL	IZL
1	-.9375	-28.125	5.0625	.2257	.0212	.0079	.1592	.2090	.0035	-.9779
2	-.8125	-24.375	5.0625	.0878	.0436	.0164	.2064	.2882	-.0078	-.9575
3	-.6875	-20.625	5.125	.17348	.0995	.0373	.2109	.4021	-.0351	-.9149
4	-.5625	-16.875	5.175	.12801	.2000	.0750	.3138	.0488	.0319	-.9983
5	-.4375	-13.125	5.225	.15128	.2679	.1005	.3603	.0650	.0188	-.9977

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE  
VALUE 1 0 16 0 1 4 0 1 0 4 ALFA= 5.00 MACHNO= .2000 FLAPD= 30.00 AILEROND= 10.00-15.00 ALTITUDE=\*\*\*\*\* 8

J	ZY/B	Y	C	SCL	SCLC/B	DLIFT	SCMC(4)	IXL	YL	IZL
6	-.3125	-9.375	11.0625	1.5560	.3980	.1155	.3400	.0476	.0161	-.9987
7	-.1875	-5.625	15.125	1.5411	.3371	.1264	.3403	.0489	.0171	-.9967
8	-.0625	-1.875	14.375	1.4982	.3590	.1346	.3652	.0679	.0199	-.9975
9	.0625	1.875	14.375	1.0559	.3608	.1353	.3641	.0660	-.0197	-.9976
10	.1875	5.625	15.125	1.5699	.3434	.1288	.3375	.0422	-.0166	-.9990
11	.3125	9.375	11.0625	1.0155	.3197	.1199	.3326	.0327	-.0156	-.9993
12	.4375	13.125	10.625	1.0286	.2884	.1082	.3392	.0251	-.0160	-.9993
13	.5625	16.875	9.375	1.0505	.2423	.0999	.3139	.0239	-.0207	-.9995
14	.6875	20.625	5.125	1.0500	.1767	.0663	.0965	.1265	-.0018	-.9920
15	.8125	24.375	5.0625	1.1281	.1293	.0485	.0910	.0975	.0023	-.9952
16	.9375	28.125	5.0625	.9927	.0837	.0314	.0888	.0616	-.0005	-.9981

CHORDWISE PRESSURE DISTRIBUTION DETAIL  
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ZY/B	SCL	* * * * * CHORD STATION (X-XLE)/C * * * * *	* * * * * CHORD PRESSURE (CPL-CPU1*IZL) * * * * *									
.00000	.10000	.20000	.30000	.40000	.50000	.60000	.70000	.80000	.90000	1.00000		
-.93750	-22394	.00000	1.14720	.09609	.35283	.16668	.03442	-.52180	-.67879	-.46203	.00000	
-.81250	.37276	.00000	1.65433	1.01203	.51954	.24824	.06495	-.23406	-.63718	-.83396	-.56809	.00000
-.68750	.69553	.00000	2.38190	1.48203	.68589	.26519	.04147	-.19268	-.47385	-.60139	-.40627	.00000
-.56250	1.26758	.00000	1.05079	1.05570	1.05704	1.03363	1.05952	1.37696	1.76307	1.79813	1.12427	.00000
-.43750	1.49469	.00000	1.36325	1.20374	1.15830	1.12711	1.51927	2.07141	2.17831	1.37605	.00000	
-.31250	1.54170	.00000	1.57360	1.37193	1.18521	1.04215	1.07802	1.45926	2.02268	2.14759	1.35966	.00000
-.18750	1.52661	.00000	1.54483	1.34693	1.16737	1.02616	1.06334	1.44846	2.01846	2.14869	1.36166	.00000
-.06250	1.47954	.00000	1.37017	1.24742	1.17273	1.08654	1.13702	1.51517	2.07175	2.18523	1.38017	.00000
.06250	1.48758	.00000	1.32153	1.20207	1.18122	1.02975	1.14208	1.51807	2.07118	2.18224	1.37772	.00000
.18750	1.55654	.00000	1.61660	1.35004	1.19584	1.04465	1.07727	1.45764	2.02099	2.14628	1.35896	.00000
.31250	1.68371	.00000	1.73160	1.47300	1.24273	1.07424	1.09775	1.46973	2.02303	2.14143	1.35431	.00000
.43750	1.61626	.00000	1.71431	1.47400	1.26257	1.10782	1.13857	1.50812	2.05038	2.15598	1.36019	.00000
.56250	1.54065	.00000	1.65213	1.49350	1.23849	1.09829	1.12230	1.44227	1.90889	1.98277	1.24683	.00000
.68750	1.30395	.00000	2.19349	1.58200	1.08733	.78122	.68276	.78758	.98184	.99991	.62768	.00000
.81250	1.12801	.00000	1.83631	1.58572	.98328	.75459	.66448	.73454	.86575	.85238	.52803	.00000
.93750	.89240	.00000	1.37073	1.49510	.77990	.61449	.56377	.63191	.74796	.73675	.45646	.00000

FILE # 2 = CHORDWISE PRESSURE DISTRIBUTION  
(VORTEX-LATTICE SOLUTION)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE  
VALUE 1 0 16 0 1 4 0 1 0 4 ALFA= 5.00 MACHNO= .2000 FLAPD= 30.00 AILEROND= 10.00-15.00 ALTITUDE=\*\*\*\*\* 9

Y	ZY/B	SCL	SCDI	SCMC(4)	SCL	SCDI	SCMC(4)	FCN	FCX	FCH
-30.000	-1.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
-28.500	-.95000	.211350	-.05000	.157626	.255351	-.021873	.169923	-.667522	.065703	.166881
-27.000	-.90000	.262320	-.021000	.163420	.304245	-.027894	.174946	-.697576	.057773	.174394
-25.500	-.85000	.319920	-.020000	.179241	.379079	-.034834	.195508	-.752306	.115413	.188077
-24.000	-.80000	.392975	-.019984	.218000	.513978	-.043915	.218166	-.863516	.059693	.215879
-22.500	-.75000	.494723	-.019097	.260024	.712633	-.070877	.323933	-.954174	.058482	.238544
-21.000	-.70000	.646929	-.019097	.238232	.919462	-.077077	.313158	-.735714	.030169	.183928
-19.500	-.65000	.865795	-.014493	.072602	.1978720	-.108538	.311153	-.044270	.073504	-.011067
-18.000	-.60000	1.110079	-.017710	.116264	.192642	-.145766	.143566	1.111887	.174742	-.277972
-16.500	-.55000	1.309547	-.021715	.134295	.2193113	-.1347213	.1924460	.254011	-.481115	
-15.000	-.50000	1.426180	-.020000	.1387815	.1394953	-.211302	.2096400	.2023364	.398997	.550591
-13.500	-.45000	1.485347	-.020000	.1363598	.1479298	-.227870	.365261	.2181211	.472546	.545303
-12.000	-.40000	1.517628	-.017099	.1340768	.1526280	-.227974	.338389	.2132749	.502963	.533187
-10.500	-.35000	1.535604	-.014094	.1335373	.1541010	-.217465	.333886	.2128010	.499477	.532902
-9.000	-.30000	1.542580	-.016599	.1335356	.1541399	-.207196	.335681	.2134788	.489267	.533697
-7.500	-.25000	1.540784	-.020790	.1333884	.1538536	-.204129	.334502	.2133996	.486293	.533499
-6.000	-.20000	1.533051	-.020049	.1334714	.1530064	-.207580	.334834	.2133683	.486540	.533421
-4.500	-.15000	1.512389	-.020003	.1342043	.1512993	-.215817	.341869	.2143509	.484450	.535877
-3.000	-.10000	1.491912	-.020030	.1353280	.1492323	-.225624	.353167	.2160066	.479888	.540017
-1.500	-.05000	1.477241	-.020000	.1362353	.1477140	-.230307	.362381	.2173242	.475508	.543313
-1.000	-.00000	1.476079	-.020001	.1365161	.1473834	-.235250	.365228	.2176532	.473209	.544133
1.500	.05000	1.483564	.020047	.1361480	.1484839	-.231758	.361501	.2170549	.473377	.542637
3.000	.10000	1.505680	.022394	.1351891	.1505925	-.222633	.351824	.2157114	.476597	.533278
4.500	.15000	1.534928	.021033	.1347097	.1535278	-.219748	.340001	.2141458	.479846	.535365
6.000	.20000	1.563015	.020075	.1331385	.1562784	-.206400	.331449	.2130541	.482603	.532635
7.500	.25000	1.584665	.019004	.1328312	.1583492	-.194649	.328683	.2127422	.483403	.531856
9.000	.30000	1.603052	.019375	.1328111	.1599889	-.193047	.328280	.2127567	.483688	.531892
10.500	.35000	1.611605	.0192601	.1327940	.1614407	-.195589	.327170	.2126671	.484741	.531668

6.3 EXAMPLE PROBLEM # 2, SINGLE SURFACE ANALYSIS CAPABILITY (CONTINUED)

12.000	.400000	1.617052	-.193449	-.329650	1.021535	.198772	-.328417	2.130054	.484090	-.532514
13.500	.450000	1.614868	-.201778	-.337417	1.611735	.197857	-.338279	2.147656	.477286	-.536914
15.000	.500000	1.599256	-.202424	-.344637	1.583082	.190816	-.349077	2.149363	.455048	-.537341
16.500	.550000	1.557017	-.160273	-.323670	1.548595	.176166	-.326818	2.027192	.359729	-.516798
18.000	.600000	1.477211	-.100703	-.253488	1.520289	.157898	-.238651	1.688015	.253743	-.422704
19.500	.650000	1.375936	-.003594	-.152782	1.490774	.138966	-.121422	1.245876	.170199	-.311669
21.000	.700000	1.280982	-.000714	-.064713	1.438798	.124210	-.041903	.927555	.089987	-.230139
22.500	.750000	1.212442	-.002047	-.072367	1.357426	.115552	-.032528	.819186	.051487	-.204797
24.000	.800000	1.146327	-.002616	-.087016	1.255644	.109213	-.056962	.824428	.053268	-.207107
25.500	.850000	1.076549	-.007166	-.096447	1.146778	.101167	-.074684	.821118	.054492	-.205287
27.000	.900000	1.069372	-.010595	-.094147	1.029936	.099084	-.077502	.770320	.047431	-.192580
28.500	.950000	.866540	-.002519	-.086750	.913493	.079632	-.073852	.770636	.026763	-.175159
30.000	1.000000	.000000	-.000000	-.000000	.000000	.000000	-.000000	.000000	.000000	-.000000

LEOF PLOT FILE 31 FILE # 3 = LIFT, INDUCED DRAG, AND PITCHING MOMENT SECTION COEFFICIENTS  
(VORTEX-LATTICE SOLUTION)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE  
VALUE 1 0 16 0 1 4 0 1 0 4 ALFA= 3.00 MACHNO= .2000 FLAPD= 30.00 AILERONU= 10.00-15.00 ALTITUDE=\*\*\*\*\* 10

WING AIRLOAD COEFFICIENTS  
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	WCL	WCOT	WCMP	WCMR	WCNY	IXL	IYL	IYL	IZL	DELTA	SCALE
WITH LE SUCTION	1.32943	.13547	-.07100	.04229	-.00086	.014089	-.000498	-.599901	.4971+35	.1661-01	
NO LE SUCTION	1.39743	.21590	-.02949	.04171	-.00028	.066015	-.000000	-.997819			

\* DIVIDE CHECK AT C41425 } OK TO IGNORE  
\* DIVIDE CHECK AT C41425 }

LINEARIZED SOLUTION WITH LE SUCTION  
\*\*\*\*\*

ALFA	ALFAFU	WCL	WCL SLOPE	CMP	CMP SLOPE	CMR	CMR SLOPE	CMY
5.000	-11.059	1.3294	.07886	.00022	.00004	.00005		

Y	ZY/B	SCLAI	SCLB	SCL	SCH(1/4)
-30.000	-1.00000	.00000	.00000	.00000	.00000
-28.000	-.95333	.91864	-.99078	.23049	.15013
-26.000	-.80007	1.00414	-.10309	.30184	.16816
-24.000	-.70000	1.07436	-.191915	.39515	.21579
-22.000	-.60007	1.06552	-.90133	.54179	.25888
-20.000	-.50007	1.07712	-.64592	.70630	.12274
-18.000	-.40000	1.05506	-.29957	1.10335	-.19570
-16.000	-.30003	1.04112	-.03879	1.34531	-.39282
-14.000	-.20007	1.03895	.07693	1.45814	-.37730

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE  
VALUE 1 0 16 0 1 4 0 1 0 4 ALFA= 3.00 MACHNO= .2000 FLAPD= 30.00 AILERONU= 10.00-15.00 ALTITUDE=\*\*\*\*\* 11

Y	ZY/B	SCLAI	SCLB	SCL	SCH(1/4)
-12.000	-.40000	1.00153	.13490	1.50624	-.33419
-10.000	-.35333	1.01472	.17054	1.52754	-.32886
-8.000	-.20007	1.05560	.20737	1.53082	-.31640
-6.000	-.20000	1.07205	.22677	1.51934	-.37483
-4.000	-.15003	1.03920	.24520	1.49391	-.32992
-2.000	-.00067	1.0801	.26150	1.46944	-.36917
0.000	-.00000	1.07622	.27103	1.46249	-.38727
2.000	-.00067	1.07675	.27261	1.47807	-.37145
4.000	-.15003	1.07708	.26758	1.51337	-.32912
6.000	-.20000	1.06977	.26226	1.55155	-.30337
8.000	-.20007	1.07244	.25959	1.57897	-.31719
10.000	-.30003	1.01131	.25239	1.59686	-.33131
12.000	-.40000	1.02966	.23658	1.60544	-.32956
14.000	-.40007	1.07202	.21469	1.59999	-.34663
16.000	-.35333	1.07083	.16639	1.56339	-.35667
18.000	-.20000	1.07182	.04186	1.46749	-.26597
20.000	-.20007	1.07018	-.11108	1.33554	-.11839
22.000	-.30003	1.070264	-.22383	1.22675	-.06493
24.000	-.40000	1.070736	-.27817	1.14081	-.09538
26.000	-.40007	1.07471	-.30617	1.02952	-.11147
28.000	-.35333	1.07814	-.32425	.89636	-.10768
30.000	1.00000	.00000	.00000	.00000	.00000

ORIGINAL PAGE IS  
OF POOR QUALITY

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE  
VALUE 1 0 16 0 1 4 0 1 0 4 ALFA= 3.00 MACHNO= .2000 FLAPD= 30.00 AILERONU= 10.00-15.00 ALTITUDE=\*\*\*\*\* 12

LINEARIZED SOLUTION WITH LE SUCTION  
\*\*\*\*\*

ALFA	ALFAFU	WCL	WCL SLOPE	CMP	CMP SLOPE	CMR	CMR SLOPE	CMY
-11.859	-11.059	.07000	.07886	.00022	.00004	.00005		

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE  
VALUE 1 0 16 0 1 4 0 1 0 4 ALFA= 3.00 MACHNO= .2000 FLAPD= 30.00 AILERONU= 10.00-15.00 ALTITUDE=\*\*\*\*\* 13

LINEARIZED SOLUTION WITH LE SUCTION  
\*\*\*\*\*

6.3 EXAMPLE PROBLEM # 2, SINGLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE  
VALUE 1 0 16 0 1 4 0 1 0 4 ALFA= 5.00 MACHNO=.2000 FLAPD= 30.00 AILEROND= 10.00-15.00 ALTITUDE=\*\*\*\*\* 16

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE  
VALUE 1 0 16 0 1 4 0 1 0 4 ALFA= 5.00 MACHNO=.2000 FLAPD= 30.00 AILEROND= 10.00-15.00 ALTITUDE=\*\*\*\*\* 20

LINARIZED SOUTION WITH LE SUCTION  
\*\*\*\*\*

ALFA	ALFAKO	WCL	WCL SLOPE	CMP SLOPE	CHR SLOPE	CMY
13.503	-11.659	2.0000	.07886	.00022	.00004	.00005

WITH LE SUCTION NO LE SUCTION FLAP/AILERON

Y	ZY/B	SCL	SCD1	SCM(C/4)	SCL	SCD1	SCM(C/4)	FON	FEX	FCH
-30.000	-1.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
-28.000	-.932333	.846498	.02695	.161354	.948306	.179898	.189343	-.509958	.021626	.127490
-26.000	-.866667	.975183	.02622	.171091	.179182	.201369	.202130	-.548887	.056085	.137222
-24.000	-.800000	1.109572	.060004	.216524	.1398895	.400929	.296068	-.662415	.028898	.165604
-22.000	-.733333	1.269711	.072117	.267835	.1861343	.753473	.430532	-.715877	-.039941	.178969
-20.000	-.666667	1.508509	.103459	.151215	.2100656	.783856	.314267	-.110460	.045348	.027610
-18.000	-.600000	1.810541	.102953	.146758	.2003084	.388527	-.093422	.1.157260	.358593	.289315
-16.000	-.533333	2.043458	.223103	.350218	.1965215	.36478	.371362	2.039362	.663232	.509841
-14.000	-.466667	2.154820	.229140	.364573	.2115320	.205799	-.375533	2.173559	.844779	.543390
-12.000	-.400000	2.197950	.207004	.335930	.219985	.292431	-.329923	2.109684	.9C8632	.527421
-10.000	-.333333	2.207985	.207457	.330483	.2125269	.295625	-.328498	2.106126	.9C0286	.526531
-8.000	-.266667	2.198371	.302923	.335216	.2192240	.298401	-.336887	2.128665	.891915	.532166
-6.000	-.200000	2.170866	.322974	.341592	.1697466	.321277	-.341486	2.143098	.853277	.535774
-4.000	-.133333	2.123763	.344949	.345769	.2125430	.364618	-.345315	2.126333	.882309	.531583
-2.000	-.066667	2.078726	.364034	.346873	.2078827	.364948	-.346845	2.093673	.843206	.523418
0.000	-.000000	2.063465	.373843	.345593	.2062856	.373147	-.345759	2.074288	.852506	.518972
2.000	-.066667	2.086115	.309000	.344100	.2081800	.369683	-.344082	2.083681	.856071	.520920
4.000	-.133333	2.141754	.353343	.343153	.2142637	.354385	-.342911	2.115630	.872627	.529907
6.000	-.200000	2.201798	.334645	.337378	.2012498	.334192	-.337529	2.135381	.864108	.533845
8.000	-.266667	2.244474	.321062	.325435	.2241490	.318140	-.326255	.2.107132	.879660	.526783
10.000	-.333333	2.275099	.309062	.318168	.2278538	.313152	-.317198	2.084673	.875953	.521168
12.000	-.400000	2.295901	.294100	.321529	.2306565	.307675	-.318597	2.096136	.877257	.524034
14.000	-.466667	2.298736	.261254	.329975	.2279681	.28726	-.335214	2.114841	.861008	.528710
16.000	-.533333	2.268043	.268734	.316765	.2323036	.221972	-.326664	2.041261	.783673	.510315
18.000	-.600000	2.183553	.229374	.236087	.2285982	.351015	-.207927	1.712967	.585816	.428242
20.000	-.666667	2.065214	.160094	.122818	.382999	.566088	-.035451	1.257704	.339441	.314426
22.000	-.733333	1.961460	.109944	.072104	.3232966	.599061	-.027916	1.015716	.212299	.254929
24.000	-.800000	1.856542	.106143	.079648	.2116473	.474832	-.008186	.985184	.156913	.246296
26.000	-.866667	1.703253	.171547	.086085	.1874422	.380624	-.039026	.942345	.187464	.235586
28.000	-.933333	1.512338	.187250	.088675	.1364193	.332212	-.047316	.855400	.161215	.213050
30.000	1.000000	.0000000	.000000	.000000	.0000000	.000000	-.000000	.000000	.000000	.000000

WITH LE SUCTION WCL= .2.00000 / WCD= .25831 / WCM(C/4)= -.26917 / L/D= 7.74255  
NO LE SUCTION .2.16861 / .42297 / -.22422 / 5.15497

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE  
VALUE 1 0 16 0 1 4 0 1 0 4 ALFA= 5.00 MACHNO=.2000 FLAPD= 30.00 AILEROND= 10.00-15.00 ALTITUDE=\*\*\*\*\* 21

LINARIZED SOUTION WING COEFFICIENTS  
\*\*\*\*\*

WITH LE SUCTION	NO LE SUCTION					
ALFA	WCL	WCD	WCM(C/4)	WCL	WCD	WCM(C/4)
-12.000	-.0112	.0156	-.2749	-.0322	.0299	-.2810
-11.000	-.0077	.0162	-.2747	.0469	.1307	-.2808
-10.000	.1400	.0175	-.2744	.1266	.0326	-.2803
-9.000	.2224	.0196	-.2742	.2070	.0358	-.2797
-8.000	.3042	.0224	-.2740	.2879	.1402	-.2790
-7.000	.3851	.0260	-.2738	.3695	.0458	-.2780
-6.000	.4620	.0303	-.2735	.4517	.0526	-.2770
-5.000	.5400	.0354	-.2733	.5346	.0607	-.2757
-4.000	.6197	.0412	-.2731	.6181	.0700	-.2743
-3.000	.6900	.0478	-.2729	.7721	.0805	-.2728
-2.000	.7774	.0551	-.2726	.7869	.0922	-.2711
-1.000	.8500	.0632	-.2724	.8722	.1051	-.2692
.000	.9301	.0721	-.2722	.9582	.1193	-.2672
1.000	1.0140	.0817	-.2720	1.0448	.1347	-.2659
2.000	1.0929	.0920	-.2718	1.1320	.1513	-.2626
3.000	1.1717	.1032	-.2715	1.2198	.1691	-.2601
4.000	1.2400	.1150	-.2713	1.3083	.1881	-.2575
5.000	1.2494	.1276	-.2711	1.3974	.2084	-.2547
6.000	1.4000	.1410	-.2709	1.4872	.2299	-.2517
7.000	1.4071	.1551	-.2706	1.5775	.2526	-.2485
8.000	1.5000	.1700	-.2704	1.6685	.2765	-.2452
9.000	1.6449	.1856	-.2702	1.7601	.3016	-.2418
10.000	1.7237	.2020	-.2700	1.8523	.3280	-.2382
11.000	1.0320	.2191	-.2697	1.9452	.3556	-.2344
12.000	1.0814	.2370	-.2695	2.0387	.3844	-.2304
13.000	1.9002	.2556	-.2693	2.1328	.4144	-.2263
14.000	2.0292	.2750	-.2691	2.2275	.4456	-.2221
15.000	2.1180	.2952	-.2688	2.3229	.4781	-.2177
16.000	2.1909	.3161	-.2686	2.4189	.5118	-.2131
17.000	2.2127	.3377	-.2684	2.5155	.5467	-.2084
18.000	2.3040	.3601	-.2682	2.6127	.5828	-.2035

(EOF PLOT FILE 4) FILE # 3 - LINEARIZED SOLUTION ARRAY (EXTRAPOLATED USING LIFTING-LINE THEORY)

\*\*\*\* JOB TIME= 133 / ELAPSED TIME= 133 / NU.PLOT FILES= 4 / ISURF EXFC. VERSION 6-1E-72 \*\*\*\*

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\*\*\*\*\*  
\*\*\*\*\*  
XQT TRWFLT OUTPUT OMITTED, SEE INPUT LISTINGS (PAGE 6-3 THROUGH 6-5)

#### 6.4 EXAMPLE PROBLEM # 3, NORTH AMERICAN XB-70 AIRPLANE

SUBSONIC-FLOW LIFTING SURFACE ANALYSIS PROGRAM HAD10DB  
TRW SYSTEMS INC., HOUSTON OPERATIONS  
HOUSTON, TEXAS 77058

\*\*\*\* JOBS INPUT LIST \*\*\*\*

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7 XGT NSURF
EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AERODYNAMIC ANALYSIS
TASK 702, PROJECT 3303A, MJO 147033, AERODYNAMIC ANALYSIS AND DESIGN
SUBSONIC-FLOW LIFTING SURFACE ANALYSIS, TRW PROGRAM NO. HAO10B (NSURF)
A.V.GOMEZ/ 5 JULY 1972

SINPUT
NWING3,NVNTAIL=-1, GSCALE=0,083333, COLOOP=0,80,
MWING1,
NSSL(1)=7,NCS(1)=2,NFLG(1)=22,NFLG(6)=6,XOC(1,1)=0.0,1,0,
X(1)=-50.5,-50.5,-50.5,-50.5,3*0.0, XOCR(1)=7*1.0,
Y(1)=0.5,-27.114,54.71,-81,229.08,400,69,629.97,
Z(1)=2*0.0,0.441,0.882,34*0.0,
E(1)=2*0.0,-0.5,-1.0,-1.5,-3.0,-3.0,
C(1)=143.08,1261.518,1110.456,984.394,908.832,532.647+26.4,
MCANRD=1
NSS(2)=9,NCS(2)=3,NFLG(2)=6,NFLG(7)=2,XOC(1,2)=0.0,0.5,1.0,
X(2)=-1723.0,-1723.0, XOCR(2)=0.55,0.31532,
Y(2)=0.0,171.81,
Z(2)=73.0,-73.0,
E(2)=2*3.0,
C(2)=249.5,96.71,
ZOC(1,8)=0.0,0.0,C.0R816,
ZOC(1,9)=0.0,0.0,C.0R816,
MFUSE1,
NSSL(3)=11,NCS(3)=2,NFLG(3)=2,NFLG(8)=3,XOC(1,3)=0.0,1,0,
X(10)=-1463.08,-1312.018, Y(10)=0.,57,27, Z(10)=2*0.0,E(10)=2*0.0,
C(10)=740.0,640.0,XOC(10)=1.0,1.0,XOC(1,3)=0.,1.0,
MFTINS=1,
NSS(4)=13, NCS(4)=2, NFLG(4)=3, NFLG(9)=2, XOC(1,4)=0.0,1,0, XOCR(12)=2*1.0,
X(12)=-50.5,36.1, Y(12)=2*171.81, Z(12)=0.882,-171.81, E(12)=-1.0,-1.0,
C(12)=328,1313,83,07,
XCG=-725.0, ZCG=5.5,YCG=0.0, RFS=90683.0, REFC=942,38, REFB=1260.0,
NJOB=1, ALFA=1, MACMN=0.20, HSOLV=1.1,1.2,1.4,
KT2= 6, NFLG(19)= 1, 0,
SEND
SENDJOB5
7 XGT NSURF

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EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AEROD  
PAGE 1

ORIGINAL PAGE IS  
OF POOR QUALITY

## 6.4 EXAMPLE PROBLEM # 3, NORTH AMERICAN XB-70 AIRPLANE (CONTINUED)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AERO PAGE  
VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 0 0 1 1 0 ALFA= ,00 MACHNO= ,0000 ALTITUDE\*\*\*\*\* 2

SURFACE # 1 = WING

LIFTING SURFACE NO# 1  
\*\*\*\*\*

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
104.995	117.756	2.200	.0000	-3.0000	6196.66	1.7790	59.019	76.777	17.943	-59.772	.970
FLAP SPAN1 .000	FLAP SPAN2 ,600	FLAP SPAN3 1.000	FLAP DEFLEC ,000	TAB DEFLEC ,000	LAIL DEFLEC ,000	RAIL DEFLEC ,000	DIMED. MGC/4 ,000	SWEEP MGC/4 56.795	NO,SPAN ELEMENTS 22	NO,CHORD ELEMENTS 6	DISCONT 0
FUS STA X(CG) -60.491	WING STA Y(CG) ,000	WL STA Z(CG) ,458	AREA S(CG) 6297.748	CHORD C(CG) 78.531	SPAN B(CG) 105.000						

WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-52.498	-52.497	,000	-2.200	-1.650	,000	-3.000	,000	-56.795	2.200	,550	,275
-47.246	-47.247	,000	-13.756	-10.317	,000	-3.000	,000	-56.795	13.756	3,439	1,718
-41.999	-41.998	,000	-25.312	-18.984	,000	-3.000	,000	-56.795	25.312	6,326	3,164
-36.749	-36.748	,000	-36.867	-27.651	,000	-3.000	,000	-56.795	36.867	9,217	4,608
-31.499	-31.498	,000	-48.423	-36.317	,000	-2.800	,000	-56.795	48.423	12,106	6,053
-26.249	-26.248	,000	-59.979	-44.984	,000	-2.250	,000	-56.795	59.979	14,995	7,497
-20.999	-20.998	,000	-71.535	-53.651	,000	-1.700	,000	-56.795	71.535	17.884	8,942
-15.749	-15.749	,051	-83.090	-63.054	-2.946	-1.150	,882	61.878	80.144	20,036	10,018
-10.500	-10.499	,044	-94.645	-72.036	-4.208	,600	,441	-56.795	90.437	22,609	11,308
-5.250	-5.250	,004	-108.075	-82.109	-4.208	,050	,441	-63.185	103.867	25,967	12,983
,000	,000	,000	-121.965	-92.525	-4.208	,000	,000	63.260	117.756	29,439	14,720
5.250	5.250	,004	-108.075	-82.109	-4.208	,050	,441	63.185	103.867	25,967	12,983
10.500	10.499	,044	-94.645	-72.036	-4.208	,600	,441	56.795	90.437	22,609	11,308
15.749	15.749	,051	-83.090	-63.054	-2.946	-1.150	,882	61.878	80.144	20,036	10,018
20.999	20.998	,000	-71.535	-53.651	,000	-1.700	,000	56.795	71.535	17.884	8,942
26.249	26.248	,000	-59.979	-44.984	,000	-2.250	,000	56.795	59.979	14,995	7,497
31.499	31.498	,000	-48.423	-36.317	,000	-2.800	,000	56.795	48.423	12,106	6,053
36.749	36.748	,000	-36.867	-27.651	,000	-3.000	,000	56.795	36.867	9,217	4,608
41.999	41.998	,000	-25.312	-18.984	,000	-3.000	,000	56.795	25.312	6,326	3,164
47.249	47.247	,000	-13.756	-10.317	,000	-3.000	,000	56.795	13.756	3,439	1,718
52.498	52.497	,000	-2.200	-1.650	,000	-3.000	,000	56.795	2.200	,550	,275

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AERO PAGE  
VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 0 0 1 1 0 ALFA= ,00 MACHNO= ,0000 ALTITUDE\*\*\*\*\* 3

X	Y	Z	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
-4.2683	,0000	,0000	XA(1)/C ,0000	XA(2)/C 1.0000	XA(3)/C ,0000	XA(4)/C ,0000	XA(5)/C ,0000	XA(6)/C ,0000	XA(7)/C ,0000	XA(8)/C ,0000	XA(9)/C ,0000	XA(10)/C ,0000
-4.2083	4.7725	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000
-4.2083	9.8450	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000
-4.2083	14.3174	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000
,0000	19.0499	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000
,0000	33.4074	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000
,0000	52.4973	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000

(EOF PLOT FILE 1) FILE # 1 = WING GEOMETRY

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AERO PAGE  
VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 0 0 1 1 0 ALFA= ,00 MACHNO= ,0000 ALTITUDE\*\*\*\*\* 4

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
28.635	28.792	8.059	3.0000	3.0000	413.07	1.9850	14.425	15.362	6.104	-147.385	-6,256
FLAP SPAN1 .000	FLAP SPAN2 ,600	FLAP SPAN3 1.000	FLAP DEFLEC ,000	TAB DEFLEC ,000	LAIL DEFLEC ,000	RAIL DEFLEC ,000	DIMED. MGC/4 ,000	SWEEP MGC/4 21.746	NO,SPAN ELEMENTS 6	NO,CHORD ELEMENTS 2	DISCONT 0
FUS STA X(CC) -60.491	WING STA Y(CC) ,000	WL STA Z(CC) ,458	AREA S(CC) 6297.748	CHORD C(CC) 78.531	SPAN B(CC) 105.000						

WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-14.317	-14.317	-6.083	-146.124	-144.109	-135.085	3.000	,000	-21.746	8.059	2,015	1,007
-12.886	-12.886	-6.083	-147.013	-144.480	-137.481	3.000	,000	-21.746	9.332	2,333	1,167
-11.454	-11.454	-6.083	-147.903	-145.251	-137.287	3.000	,000	-21.746	10.606	2,651	1,226
-10.022	-10.022	-6.083	-146.792	-145.822	-136.913	3.000	,000	-21.746	11.879	2,970	1,185
-8.590	-8.590	-6.083	-149.682	-146.394	-136.530	3.000	,000	-21.746	13.152	3,288	1,644
-7.159	-7.159	-6.083	-150.573	-146.965	-136.146	3.000	,000	-21.746	14.425	3,066	1,003
-5.727	-5.727	-6.083	-151.460	-147.536	-135.782	3.000	,000	-21.746	15.699	3,325	1,962
-4.295	-4.295	-6.083	-152.350	-148.107	-135.378	3.000	,000	-21.746	16.972	4,243	2,121
-2.863	-2.863	-6.083	-153.239	-148.678	-134.994	3.000	,000	-21.746	18.245	4,561	2,281
-1.432	-1.432	-6.083	-154.129	-149.249	-134.610	3.000	,000	-21.746	19.318	4,880	2,440
,000	,000	-6.083	-155.018	-149.820	-134.227	3.000	-6,510	-70.370	20.792	5,198	2,599
1.432	1.432	-6.083	-154.129	-149.249	-134.610	3.000	,000	-21.746	19.518	4,860	2,440
2.863	2.863	-6.083	-153.239	-148.678	-134.994	3.000	,000	-21.746	18.245	4,561	2,281
4.295	4.295	-6.083	-152.350	-148.107	-135.378	3.000	,000	-21.746	16.972	4,243	2,121

6.4 EXAMPLE PROBLEM # 3, NORTH AMERICAN XB-70 AIRPLANE (CONTINUED)

5.727	5.727	-6.083	-151.460	-147.936	+139.762	3.000	.000	21.746	15.899	3.929	1.962
7.159	7.159	-6.083	-150.571	-146.965	+136.146	3.000	.000	21.746	14.425	3.606	1.803
8.590	8.590	-6.083	-149.582	-146.394	+136.530	3.000	.000	21.746	13.152	3.288	1.644
10.022	10.022	-6.083	-148.792	-145.822	+136.913	3.000	.000	21.746	11.879	2.970	1.485
11.454	11.454	-6.083	-147.903	-145.251	+137.297	3.000	.000	21.746	10.606	2.651	1.326
12.886	12.886	-6.083	-147.013	-144.680	+137.661	3.000	.000	21.746	9.332	2.333	1.167
14.317	14.317	-6.083	-146.124	-144.109	+138.085	3.000	.000	21.746	8.059	2.015	1.007

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AERO PAGE  
VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 0 1 1 0 ALFA= ,00 MACHNO= ,0000 ALTITUDE\*\*\*\*\* 3

X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
		,0000	,5000	1.0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000

X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
-143.5828	,0000	,0000	,0000	,0882	,0000	,0000	,0000	,0000	,0000	,0000	,0000
-143.5828	14.3174	,0000	,0000	,0882	,0000	,0000	,0000	,0000	,0000	,0000	,0000

(EOF PLOT FILE 2) FILE # 2 = CANARD CONTROL SURFACE GEOMETRY

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AERO PAGE  
VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 0 0 1 1 0 ALFA= ,00 MACHNO= ,0000 ALTITUDE\*\*\*\*\* 6

SURFACE # 3 = FUSELAGE

LIFTING SURFACE NO. 3  
\*\*\*\*\*

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
9.545	61.666	53.333	,0000	,0000	548.83	,1660	57.500	57.600	2,329	-150.981	,000
FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	DEFLEC	DEFLEC	LAIL	RAIL	DIMED.	SWEEP	NO,SPAN ELEMENTS	NO,CHORD ELEMENTS	NO,CHORD DISCONT.
,000	,621	1.000	,000	,000	,000	,000	,000	,000	2	3	0
			FUS STA	WING STA	WL STA	AREA	CHORD	SPAN			
			X(CG)	Y(CG)	Z(CG)	S(CG)	C(CG)	B(CG)			
			-60.491	,000	,458	6297.748	78.531	105.000			

WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-4.772	-4.772	,000	-162.668	-149.334	-109.334	,000	,000	-75.784	53.333	13.333	6.667
-4.295	-4.295	,300	-164.780	-151.218	-110.593	,000	,000	-75.784	54.166	13.542	6.771
-3.818	-3.818	,000	-166.852	-153.102	-113.852	,000	,000	-75.784	55.000	13.750	6.875
-3.341	-3.341	,000	-168.944	-154.986	-113.111	,000	,000	-75.784	55.833	13.958	6.979
-2.863	-2.863	,000	-171.036	-156.870	-114.370	,000	,000	-75.784	56.666	14.167	7.083
-2.386	-2.386	,000	-173.128	-158.755	-115.629	,000	,000	-75.784	57.500	14.375	7.187
-1.909	-1.909	,000	-175.221	-160.637	-116.887	,000	,000	-75.784	58.333	14.583	7.292
-1.432	-1.432	,000	-177.313	-162.521	-118.146	,000	,000	-75.784	59.166	14.792	7.395
-0.954	-0.954	,000	-179.405	-164.405	-119.405	,000	,000	-75.784	60.000	15.000	7.500
-0.477	-0.477	,000	-181.497	-166.289	-120.664	,000	,000	-75.784	60.833	15.208	7.604
,000	,000	,000	-183.589	-168.173	-122.923	,000	,000	-75.784	61.666	15.417	7.708
,477	,477	,000	-181.497	-166.289	-120.664	,000	,000	-75.784	60.833	15.208	7.604
,954	,954	,000	-179.405	-164.405	-119.405	,000	,000	-75.784	60.000	15.000	7.500
1.432	1.432	,000	-177.313	-162.521	-118.146	,000	,000	-75.784	59.166	14.792	7.395
1.909	1.909	,000	-175.221	-160.637	-116.887	,000	,000	-75.784	58.333	14.583	7.292
2.386	2.386	,000	-173.128	-158.753	-115.629	,000	,000	-75.784	57.900	14.375	7.187
2.863	2.863	,000	-171.036	-156.870	-114.370	,000	,000	-75.784	56.666	14.167	7.083
3.341	3.341	,000	-168.944	-154.986	-113.111	,000	,000	-75.784	55.833	13.958	6.979
3.818	3.818	,000	-166.852	-153.102	-111.852	,000	,000	-75.784	55.300	13.750	6.875
4.295	4.295	,000	-164.760	-151.218	-110.593	,000	,000	-75.784	54.166	13.542	6.771
4.772	4.772	,000	-162.668	-149.334	-109.334	,000	,000	-75.784	53.333	13.333	6.667

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AERO PAGE  
VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 0 0 1 1 0 ALFA= ,00 MACHNO= ,0000 ALTITUDE\*\*\*\*\* 7

X	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
			,0000	1.0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000

X	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-121.9228	,0000	,0000	-164.760	-151.218	-110.593	,000	,000	,0000	,0000	,0000	,0000
-109.3344	4.7725	,0000	-166.852	-153.102	-111.852	,0000	,0000	,0000	,0000	,0000	,0000

(EOF PLOT FILE 3) FILE # 3 = FUSELAGE GEOMETRY

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AERO PAGE  
VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 0 0 1 1 0 ALFA= ,00 MACHNO= ,0000 ALTITUDE\*\*\*\*\* 8

SURFACE # 4 = VERTICAL FINS  
\*\*\*\*\*

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
14.391	27.344	6.922	-1.0000	-1.0000	246.56	,8399	17.133	19.162	14.317	-15.691	-5.442

6.4 EXAMPLE PROBLEM # 3, NORTH AMERICAN XB-70 AIRPLANE (CONTINUED)

FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	DIMED. MCC/4	SWEEP MCC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
FUS STA WING STA WLE STA AREA CHORD SPAN											
			X(CG)	Y(CG)	Z(CG)	S(CG)	C(CG)	B(CG)	3	2	0
-60,491	,000	,000	-60,491	,000	,058	6297,748	78,931	105,000			
.000	14,317	,073	-31,552	-24,716	-4,208	-1,000	,441	85,620	27,344	6,536	3,415
.720	14,317	-,646	-30,171	-23,590	-3,848	-1,000	89,999	57,424	26,323	6,581	3,290
1.439	14,317	-1,366	-28,789	-22,464	-3,467	-1,000	89,999	57,424	25,302	6,525	3,163
2.159	14,317	-2,085	-27,408	-21,338	-3,127	-1,000	89,999	57,424	24,281	6,070	3,035
2.878	14,317	-2,805	-26,026	-20,212	-2,767	-1,000	89,999	57,424	23,260	5,515	2,907
3.598	14,317	-3,524	-24,645	-19,085	-2,406	-1,000	89,999	57,424	22,239	5,560	2,783
4.317	14,317	-4,244	-23,263	-17,959	-2,046	-1,000	89,999	57,424	21,218	5,504	2,658
5.037	14,317	-4,963	-21,882	-16,833	-1,689	-1,000	89,999	57,424	20,197	5,049	2,528
5.756	14,317	-5,683	-20,500	-15,707	-1,323	-1,000	89,999	57,424	19,178	4,794	2,397
6.476	14,317	-6,402	-19,119	-14,580	-985	-1,000	89,999	57,424	18,156	4,839	2,269
7.195	14,317	-7,122	-17,737	-13,454	-604	-1,000	89,999	57,424	17,133	4,283	2,148
7.915	14,317	-7,842	-16,356	-12,328	-244	-1,000	89,999	57,424	16,112	4,228	2,014
8.635	14,317	-8,561	-14,974	-11,202	117	-1,000	89,999	57,424	15,091	3,773	1,886
9.354	14,317	-9,281	-13,593	-10,075	477	-1,000	89,999	57,424	14,070	3,218	1,759
10.074	14,317	-10,000	-12,211	-8,949	837	-1,000	89,999	57,424	13,049	3,282	1,631
10.793	14,317	-10,720	-10,830	-7,823	1,198	-1,000	89,999	57,424	12,028	3,007	1,503
11.513	14,317	-11,439	-9,448	-6,697	1,558	-1,000	89,999	57,424	11,007	2,752	1,376
12.232	14,317	-12,159	-8,067	-5,571	1,919	-1,000	89,999	57,424	9,986	2,496	1,248
12.952	14,317	-12,878	-6,685	-4,444	2,279	-1,000	89,999	57,424	8,968	2,241	1,121
13.671	14,317	-13,598	-5,304	-3,318	2,640	-1,000	89,999	57,424	7,944	1,986	993
14.391	14,317	-14,317	-3,922	-2,192	3,000	-1,000	89,999	57,424	6,923	1,731	868

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AERO PAGE  
VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 0 1 1 0 ALFA= 10,00 MACHNO= 1,0000 ALTITUDE\*\*\*\*\* 9

X	Y	Z	XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C
,0000	1.0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000
-4.2083	14.3174	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000
3.0000	14.3174	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000

(EOF PLOT FILE 4) FILE # 4 - LEFT VERTICAL FIN GEOMETRY

(EOF PLOT FILE 5) FILE # 5 = RIGHT VERTICAL FIN GEOMETRY (IMAGE)

NOTATION = 1/(1,1), INDICATES SOLUTION FOR SURFACE # 1 IS OUTPUT  
CONSIDERING SURFACE # 1 ALONE.

SECTION AIRLOAD COEFFICIENTS-SURFACE NO. 1/( 1, 1)

J	Y*	Y	Z	W	SCN	SCX	SCY	SCD	SMP C/4	SLC/B	1XL	1YL	1ZL
12	,0227	2,386	,000	2,386	,2030	,0019	,1996	,0356	-,0496	,2118	,0034	,0011	-1,0000
13	,0682	7,159	,368	7,159	,2600	-,0018	,2564	,0448	-,0431	,2413	,0081	,0315	-1,9995
14	,1136	11,931	1,026	11,931	,2622	-,0062	,2593	,0445	-,0515	,2156	,0089	,0265	-1,9996
15	,1591	16,703	1,517	16,704	,3139	-,0071	,3103	,0533	-,0405	,2332	,0196	,0195	-1,9996
16	,2045	21,476	1,844	21,477	,3283	-,0146	,3289	,0545	-,0241	,2188	,0384	,0175	-1,9992
17	,2500	26,248	2,022	26,249	,3339	-,0271	,3335	,0533	-,0180	,1905	,0398	,0139	-1,9991
18	,2958	31,021	2,040	31,022	,3442	-,0341	,3449	,0538	-,0192	,1625	,0496	,0118	-1,9987
19	,3409	35,793	1,770	35,794	,3752	-,0407	,3766	,0581	-,0239	,1398	,0597	,0009	-1,9984
20	,3864	40,566	1,293	40,567	,4301	-,0493	,4321	,0661	-,0281	,1171	,0562	,0011	-1,9984
21	,4318	45,338	,816	45,339	,5193	-,0455	,5228	,0788	-,0349	,0894	,0564	,0020	-1,9982
22	,4773	50,111	,338	50,112	,7439	-,1086	,7315	,1103	-,0721	,0833	,0666	,0039	-1,9978

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AERO PAGE  
VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 0 1 1 0 ALFA= 10,00 MACHNO= 1,0000 ALTITUDE\*\*\*\*\* 10

ORIGINAL PAGE IS  
OF POOR QUALITY

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS.\* 1 - 1

E	ECN	ECX	ECY	ECZ	ECDD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	,3048	-,0160	-,0000	,3030	,0372	-,0622	-,0000	-,0000	,59,77	,97	6196,66	76,78	104,99
1	,0396*	,0163*	,0000*	,0361*	,0230*	-,0064*	-,0000*	-,0000*	,59,77*	,97*	6196,66*	76,78*	104,99*
*** AIRLOAD SUMS ***													
AC	,3048	-,0160	-,0000	,3030	,0372	-,0622	-,0000	-,0000	,59,77	,97	6196,66	76,78	104,99
CG	,2999	-,0157	,0000	,2981	,0366	-,0624	-,0000	-,0000	,60,49	,46	6297,75	78,53	105,00
AC	,0396*	,0163*	,0000*	,0361*	,0230*	-,0064*	-,0000*	-,0000*	,59,77*	,97*	6196,66*	76,78*	104,99*
CG	,0389*	,0161*	,0000*	,0356*	,0228*	-,0066*	-,0000*	-,0000*	,60,49*	,46	6297,75*	78,53*	105,00*

> DETERMINANT = ,1875+13 \* SCALE = ,1731-01 \*

LIFT COEFFICIENT FOR WING ALONE IS  $C_L = 0.2881$  WITH L.E. SUCTION (BLUNT L.E.)  
= 0.3337 NO L.E. SUCTION (SHARP L.E.)

SECTION AIRLOAD COEFFICIENTS-SURFACE NO. 1/( 1, 2)

NOTATION = 1/(1,2), INDICATES SOLUTION FOR SURFACE # 1 IS OUTPUT  
CONSIDERING SURFACES # 1 AND # 2 SIMULTANEOU

6.4 EXAMPLE PROBLEM # 3, NORTH AMERICAN XB-70 AIRPLANE (CONTINUED)

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
12	.0227	2,386	.000	2,386	.1354	.0041	.1327	.0242	-.0469	.1408	-.0027	.0009	-.10000
13	.0502	7,159	.368	7,159	.1769	.0004	.1742	.0308	-.0438	.1640	-.0074	.0313	-.9995
14	.1136	11,931	1,026	11,931	.1944	-.0033	.1920	.0332	-.0445	.1596	-.0091	.0266	-.9996
15	.1591	16,723	1,517	16,704	.2452	-.0049	.2423	.0417	-.0399	.1821	-.0197	.0197	-.9996
16	.2045	21,476	1,846	21,477	.2743	-.0110	.2722	.0456	-.0259	.1827	-.0353	.0174	-.9992
17	.2500	26,248	2,022	26,249	.2932	-.0230	.2928	.0469	-.0196	.1872	-.0397	.0138	-.9991
18	.2955	31,021	2,040	31,022	.3134	-.0304	.3139	.0491	-.0199	.1479	-.0496	.0118	-.9987

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE  
VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 1 1 0 ALFA= 10.00 MACHNO= ,2000 ALTITUDE\*\*\*\*\* 11

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
19	.3400	35,793	1,770	35,794	.3497	-.0374	.3509	.0542	-.0240	.1302	-.0556	.0009	-.9985
20	.3864	47,566	1,293	40,567	.4081	-.0464	.4100	.0628	-.0278	.1111	-.0561	.0010	-.9984
21	.4318	45,338	.816	45,339	.4997	-.0627	.5030	.0759	-.0345	.0860	-.0593	.0019	-.9982
22	.4773	50,111	.338	50,112	.7241	-.1053	.7313	.1074	-.0711	.0519	-.0664	.0039	-.9978

SECTION AIRLOAD COEFFICIENTS-SURFACE NO. # 2/( 1, 2)  
\*\*\*\*\*

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
27	.0833	2,386	-6,196	107,733	.9782	.0097	.9478	.1854	-.1495	.6179	.1061	-.0158	-.9942
28	.2500	7,159	-6,112	112,505	1,1336	.0804	1,1024	.2108	-.1194	.5554	.1311	-.0246	-.9911
29	.4167	11,931	-6,063	117,278	1,1479	.0670	1,1189	.2110	-.1132	.3978	.1249	-.0314	-.9917

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS. # 1 + 2  
\*\*\*\*\*

E	EON	EEX	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMG	EB
1	.2479	-.0132	.0000	.2464	.0300	-.0667	-.0000	-.0000	-.59,77	.97	6196,66	76,78	104,99
1	.033R*	.0140*	.0000*	.0308*	.0196*	-.0070*	-.0000*	-.0000*	-.59,77*	.97*	6196,66*	76,78*	104,99*
2	1.0700	.0313	.0000	1.0396	.2658	-.1462	-.0000	-.0000	-.147,38	-6,26	413,07	15,36	28,63
2	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	-.147,38*	-6,26*	413,07*	15,36*	28,63*

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE  
VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 1 1 0 ALFA= 10.00 MACHNO= ,2000 ALTITUDE\*\*\*\*\* 12

\*\*\* AIRLOAD SUMS \*\*\*

AC	.3192	-.0678	.0000	.3157	.0478	.0133	-.0000	-.0000	-.59,77	.97	6196,66	76,78	104,99
CG	.3141	-.0677	.0000	.3106	.0470	.0094	-.0000	-.0000	-.60,49	.46	6297,75	78,53	105,00
AC	.033R*	.0140*	.0000*	.0308*	.0196*	-.0070*	-.0000*	-.0000*	-.59,77*	.97*	6196,66*	76,78*	104,99*
CG	.033R*	.0157*	.0000*	.0303*	.0195*	-.0072*	-.0000*	-.0000*	-.60,49*	.46*	6297,75*	78,53*	105,00*

\* DETERMINANT= -.1070+22 \* SCALE= ,1505-01 \*

LIFT COEFFICIENT FOR WING +CANARD CONTROL SURFACE IS

C<sub>L</sub> = 0.3108 (WITH L.E. SUCTION)

SECTION AIRLOAD COEFFICIENTS-SURFACE NO. # 1/( 1, 4) NOTATION = 1/(1,4), INDICATES SOLUTION FOR SURFACE # 1 IS OUTPUT  
\*\*\*\*\* CONSIDERING SURFACES #1, #2, #3, and #4 SIMULTANEOUSLY

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
12	.0227	2,386	.000	2,386	.1155	.0003	.1137	.0201	-.0356	.1207	-.0129	.0043	-.9999
13	.0502	7,159	.368	7,159	.1494	-.0023	.1476	.0256	-.0329	.1389	-.0303	.0348	-.9988
14	.1136	11,931	1,026	11,931	.1832	-.0060	.1805	.0317	-.0271	.1501	-.0833	.0449	-.9954
15	.1591	16,723	1,517	16,704	.2314	-.0024	.2283	.0398	-.0596	.1715	-.0191	.0209	-.9998
16	.2045	21,476	1,846	21,477	.2616	-.0126	.2598	.0432	-.0402	.1744	-.0244	.0150	-.9995
17	.2500	26,248	2,022	26,249	.2986	-.0148	.2966	.0493	-.0296	.1694	-.0426	.0145	-.9990
18	.2955	31,021	2,040	31,022	.3212	-.0305	.3217	.0505	-.0213	.1516	-.0440	.0108	-.9989
19	.3400	35,793	1,770	35,794	.3511	-.0372	.3523	.0545	-.0240	.1307	-.0555	.0009	-.9985
20	.3864	47,566	1,293	40,567	.4076	-.0455	.4093	.0629	-.0280	.1110	-.0555	.0009	-.9985
21	.4318	45,338	.816	45,339	.4988	-.0615	.5019	.0759	-.0346	.0858	-.0503	.0019	-.9982
22	.4773	50,111	.338	50,112	.7226	-.1047	.7298	.1073	-.0710	.0518	.0363	.0039	-.9978

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE  
VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 1 1 0 ALFA= 10.00 MACHNO= ,2000 ALTITUDE\*\*\*\*\* 13

SECTION AIRLOAD COEFFICIENTS-SURFACE NO. # 2/( 1, 4)  
\*\*\*\*\*

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
27	.0833	2,386	-6,196	107,733	1.0252	.1017	.0920	.1957	-.1455	.6468	.1166	-.0164	-.9930
28	.2500	7,159	-6,112	112,505	1.2074	.0904	1.1734	.2254	-.1308	.5911	.1312	-.0246	-.9911
29	.4167	11,931	-6,063	117,278	1.2471	.0793	1.2144	.2303	-.1267	.4318	.1267	-.0315	-.9914

SECTION AIRLOAD COEFFICIENTS-SURFACE NO. # 3/( 1, 4)  
\*\*\*\*\*

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
32	.2500	2,386	.000	137,607	.0288	.0079	.0270	.0064	-.0150	.1626	.0693	-.2129	-.9746

6.4 EXAMPLE PROBLEM # 3, NORTH AMERICAN XB-70 AIRPLANE (CONTINUED)

SECTION AIRLOAD COEFFICIENTS-SURFACE NO. # 4/( 1, 4)

SECTION LIFT COEFFICIENTS FOR SURFACE # 4 ARE OUT OF RANGE

SEE NOTE # 1. \*

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SLC/B	1XL	1YL	1ZL
38	.9940	14.317	-2.074	151.937*****		943.53992580.0793*****					.0768	.9943	.0766
39	.9940	14.317	-6.943	156.7346153.4659*****	6682.7775	445.7413 786.36737956.2465					.0032	-1.0000	.0033
40	.9940	14.317	-11.811	161.531 75.2273	-93.2598	90.2788 -3.1313 -93.5006	64.7788				.0162	.9997	-.0165

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS. # 1 ~ 4

E	ECN	ECK	ECY	ECL	ECD	ECMP	ECHR	ECHY	EXA	EZA	E5	EMGC	EB

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 3 = XB-70 AIRPLANE SUBSONIC AEROD PAGE  
VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 0 1 1 0 ALFA= 10.00 MACHNO= ,2000 ALTITUDE\*\*\*\*\* 14

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS. # 1 ~ 4

E	ECN	ECK	ECY	ECL	ECD	ECMP	ECHR	ECHY	EXA	EZA	E5	EMGC	EB
1	+2368	+0129	+0000	+2355	+0285	+0651	+0000	+59.77	+97	6196.66	76.78	104.99	
1	+0314*	+0129*	+0000*	+0284*	+0182*	+0070*	+0000*	+59.77*	+97*	6196.66*	76.78*	104.99*	
2	+1382	+0927	+0000	+1048	+2889	+1511	+0000	+147.38	+6.26	413.07	15.36	28.63	
2	+0000*	+0000*	+0000*	+0000*	+0000*	+0000*	+0000*	+147.38*	+6.26*	413.07*	15.36*	28.63*	
3	+0288	+0079	+0000	+0270	+0128	+0151	+0000	+158.98	+00	548.83	49.46	9.54	
3	+0000*	+0000*	+0000*	+0000*	+0000*	+0000*	+0000*	+158.98*	+00*	548.83*	57.40*	9.54*	
4	+0710	+0372	+0000	+0764	+0243	+0324	+0000	+15.69	+5.44	492.13	16.16	14.39	
4	*****	+0372*	+0000*****	+0759.033*****		+0000*	+0000*	+15.69*	+5.44*	492.13*	16.16*	14.39*	

\*\*\* AIRLOAD SUMS \*\*\*

AC	+3209	+0089	+0000	+3176	+0469	+0195	+0000	+59.77	+97	6196.66	76.78	104.99
CG	+3157	+0088	+0000	+3125	+0462	+0159	+0000	+60.49	+64	6297.75	78.53	105.00
AC	272.7076*	+0159*	+0000*+248.5618*	47.3708*****	+0000*	+0000*	+0000*	+59.77*	+97*	4196.66*	74.70*	104.99*
CG	268.3302*	+0156*	+0000*+244.2510*	46.6104*****	+0000*	+0000*	+0000*	+60.49*	+64*	6297.75*	78.53*	105.00*

\* DETERMINANT = .5384+32 \* SCALE = .1409-01 \*

VORTEX-LIFT INCREMENTS FOR SURFACE # 4 ARE OUT OF RANGE

SEE NOTE # 2. +

\*\*\*\* JOB TIME= 246 / ELAPSED TIME= 246 / NO.PLOT FILES= 5 / NSURF EXEC VERSION 6-18-72 \*\*\*\*

\*\*\*\*\*

XQT TRWPLT PRINTED OUTPUT OMITTED

SEE INPUT DATA LISTINGS

\* NOTES: [1] THE SECTION COEFFICIENTS CALCULATED FOR SURFACE # 4, THE VERTICAL FINS, ARE OUT OF RANGE OF THE "FM" FORMAT SPECIFICATION USED FOR THE PRINTED OUTPUT. THIS ANOMALY ARISES BECAUSE OF THE MANNER IN WHICH THESE COEFFICIENTS ARE CALCULATED, i.e., THE AIRLOADS OBTAINED IN THE VORTEX-LATTICE SOLUTION ARE NORMALIZED BY (DIVIDED BY) THE PROJECTED AREA OF THE SURFACE ON A HORIZONTAL PLANE WHICH IS OF ZERO ORDER FOR A VERTICAL SURFACE. THIS PROGRAMMING ERROR DOES NOT IN ANY WAY AFFECT THE ACCURACY OF THE VORTEX-LATTICE SOLUTION OR THE SPATIALLY-INTEGRATED AIRLOAD COEFFICIENTS WHICH ARE NORMALIZED BY A DIFFERENT AREA.

[2] THE VORTEX-LIFT INCREMENTS CALCULATED FOR SURFACE # 4, THE VERTICAL FINS, ARE OUT OF RANGE AND IN ERROR FOR THE SAME REASONS OUTLINED IN NOTE # 1.

[3] TO DEMONSTRATE THE VERACITY OF THE SOLUTIONS CALCULATED WITH AND WITHOUT VERTICAL FINS A COMPARISON OF THE NET-AIRLOAD COEFFICIENTS ABOUT THE C.G. OBTAINED FOR THE VORTEX-LATTICE SOLUTIONS (WITH L.E. SUCTION) IS GIVEN BELOW

CODE	DESCRIPTION	C <sub>L</sub>	C <sub>D1</sub>	C <sub>MCG</sub>
(1,1)	WING ALONE	0.2981	0.0366	-0.0624
(1,2)	WING + CANARD	0.3106	0.0470	+0.0099
(1,4)	WING + CANARD + FUSELAGE + VERT. FINS	0.3125	0.0462	+0.0159

## 6.5 EXAMPLE PROBLEM # 4, THICK-WING ANALYSIS

SUBSONIC-FLOW LIFTING SURFACE ANALYSIS PROGRAM HAD10B  
TRW SYSTEMS INC., HOUSTON OPERATIONS  
HOUSTON, TEXAS 77058

\*\*\* JOBS INPUT LIST \*\*\*

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7 XQT NSURF
EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMIC ANALYSIS
TASK T02, PROJECT 3303A, MJD 147033, AERODYNAMIC ANALYSIS AND DESIGN
SUBSONIC-FLOW LIFTING SURFACE ANALYSIS, TRK PROGRAM NO. HAD10B (NSURF)
A.V.GOMEZ / 5 JULY 1972

$INPUT
NWING=3, NYTAIL=0, NFUS=0, CDLOC0=0.75,
NFLG(1)=3*10, NFLG(6)=3*5, NFLG(19)=1,2,
NCS=2*10,2, NSS=2*4,6,
THICKn=1,
XOC(1,1)= .00, .05, .10, .15, .20, .30, .40, .60, .80, 1.0,
XOC(1,2)= .00, .05, .10, .15, .20, .30, .40, .60, .80, 1.0,
ZOC(1,1)=0.,0.04443,-.05853,-.06682,-.07172,-.07502,-.07254,-.05704,-.03279,0.,
ZOC(1,2)=0.,0.04443,-.05853,-.06682,-.07172,-.07502,-.07254,-.05704,-.03279,0.,
ZOC(1,3)=0.,-0.04443,-.05853,-.06682,-.07172,-.07502,-.07254,-.05704,-.03279,0.,
ZOC(1,4)=0.,-0.04443,-.05853,-.06682,-.07172,-.07502,-.07254,-.05704,-.03279,0.,
X = 0.0, 0.0,
Y = 0.10, 0.10,
Z = 0.0, 0.0,
C = 10,10, 10,10,
E = 0.0, 0.0,
Z = 0.0, 0.0,
FLATP=1,
XOC(1,3)= .00, 1.0,
ZOC(1,5)=0., 0.,
ZOC(1,6)=0., 0.,
X(5)= 0.0,
Y(5)= 0.10,
Z(5)= 0.0,
C(5)= 10,10,
E(5)= 0.0,
XCG=0.0, REFB=10.0, REFS=200.0, NUDB=1, ALFA=10, MACHN=0.0, NSOLV=1,2,3,3
$END
$ENDJOBS
7 XQT NSURF

```

JDBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EX:AMPLE PROBLEM NO. 4 - THICK WING PROBLEM AEROODYNAMIC PAGE  
VALUE 10 10 10 0 0 0 5 5 5 0 0 0 0 0 0 0 0 0 1 1 20 ALFA= \*\*\*\*\* MACHNUM = 0.0000 ALTITUDE=\*\*\*\*\* 1

ORIGINAL PAGE IS  
OF POOR QUALITY

## 6.5 EXAMPLE PROBLEM # 4, THICK-WING ANALYSIS (CONTINUED)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMIC PAGE  
VALUE 10 10 10 0 0 5 5 5 0 0 0 0 0 0 0 0 0 1 1 2 ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 2

LIFTING SURFACE NO= 1 SURFACE # 1 = LOWER SURFACE  
\*\*\*\*\*

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
20.000	10.000	10.000	.0000	.0000	200.00	2.0000	10.000	10.000	5.000	.000	.734
FLAP SPAN1 .000	FLAP SPAN2 .600	FLAP SPAN3 1.000	FLAP DEFLEC .000	TAB DEFLEC .000	L.AIL DEFLEC .000	R.AIL DEFLEC .000	DIMED. MGC/4 .000	SWEET MGC/4 .000	NO.SPAN ELEMENTS 10	NO.CHORD ELEMENTS 5	NO.CHORD DISCONT. D
FUS STA X(CG) .000	WING STA Y(CG) .000	WL STA Z(CG) .000	AREA S(CG)	CHORD C(CG) 10.000	SPAN B(CG) 20.000						

WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(IFLAP)	C(TAB)
-10.000	-10.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-9.000	-9.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-8.000	-8.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-7.000	-7.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-6.000	-6.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-5.000	-5.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-4.000	-4.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-3.000	-3.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-2.000	-2.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-1.000	-1.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
0.000	0.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
1.000	1.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
2.000	2.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
3.000	3.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
4.000	4.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
5.000	5.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
6.000	6.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
7.000	7.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
8.000	8.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
9.000	9.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
10.000	10.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMIC PAGE  
VALUE 10 10 10 0 0 5 5 5 0 0 0 0 0 0 0 0 0 1 1 2 ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 3

X	Y	Z	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
0.000	.0000	.0000	.0444	.0585	.0668	.0717	.0750	.0725	.0570	.0328	.0000	
0.000	10.000	.0000	.0444	.0585	.0668	.0717	.0750	.0725	.0570	.0328	.0000	

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMIC PAGE  
VALUE 10 10 10 0 0 5 5 5 0 0 0 0 0 0 0 0 0 1 1 2 ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 5

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
20.000	10.000	10.000	.0000	.0000	200.00	2.0000	10.000	10.000	5.000	.000	.734
FLAP SPAN1 .000	FLAP SPAN2 .600	FLAP SPAN3 1.000	FLAP DEFLEC .000	TAB DEFLEC .000	L.AIL DEFLEC .000	R.AIL DEFLEC .000	DIMED. MGC/4 .000	SWEET MGC/4 .000	NO.SPAN ELEMENTS 10	NO.CHORD ELEMENTS 5	NO.CHORD DISCONT. 0
FUS STA X(CG) .000	WING STA Y(CG) .000	WL STA Z(CG) .000	AREA S(CG)	CHORD C(CG) 10.000	SPAN B(CG) 20.000						

WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(IFLAP)	C(TAB)
-10.000	-10.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-9.000	-9.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-8.000	-8.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-7.000	-7.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-6.000	-6.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-5.000	-5.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-4.000	-4.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-3.000	-3.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-2.000	-2.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-1.000	-1.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
0.000	0.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
1.000	1.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
2.000	2.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
3.000	3.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
4.000	4.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
5.000	5.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
6.000	6.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
7.000	7.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
8.000	8.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
9.000	9.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
10.000	10.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250

## 6.5 EXAMPLE PROBLEM # 4, THICK-WING ANALYSIS (CONTINUED)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMIC PAGE  
 VALUE 10 10 10 0 0 5 5 5 0 0 0 0 0 0 0 0 0 1 1 2 ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 7

X	Y	Z	X(1)/C	X(2)/C	X(3)/C	X(4)/C	X(5)/C	X(6)/C	X(7)/C	X(8)/C	X(9)/C	X(10)/C
.0000	.0000	.0000	.0000	.0500	.1000	.1500	.2000	.3000	.4000	.6000	.8000	1.0000
X	Y	Z	Z(1)/C	Z(2)/C	Z(3)/C	Z(4)/C	Z(5)/C	Z(6)/C	Z(7)/C	Z(8)/C	Z(9)/C	Z(10)/C
.0000	.0000	.0000	.0000	.0444	.0585	.0668	.0717	.0750	.0725	.0570	.0328	.0000
.0000	10.0000	.0000	.0000	.0444	.0585	.0668	.0717	.0750	.0725	.0570	.0328	.0000

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMIC PAGE  
 VALUE 10 10 10 0 0 5 5 5 0 0 0 0 0 0 0 0 0 1 1 2 ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 10

LIFTING SURFACE NO= 3 SURFACE # 3 = THIN WING (FLAT PLATE)  
 \*\*\*\*\*

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MACH)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
20.000	10.000	10.000	.0000	.0000	200.00	2.0000	10.000	10.000	5.000	.000	.000
FLAP SPAN1 .000	FLAP SPAN2 .600	FLAP SPAN3 1.000	DEFLEC .000	TAB DEFLEC .000	L.AIL DEFLEC .000	R.AIL DEFLEC .000	CIMED-MGC/4 .000	SWEEP MGC/4 .000	ND.SPAN ELEMENTS 10	NO.CHORD ELEMENTS 5	NO.CHORD DISCONT. 0
FUS STA X(CG)	WING STA Y(CG)	WL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)						
.000	.000	.000	200.000	10.000	20.000						

WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(IFLAP)	C(TAB)
-10.000	-10.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-9.000	-9.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-8.000	-8.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-7.000	-7.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-6.000	-6.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-5.000	-5.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-4.000	-4.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-3.000	-3.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-2.000	-2.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-1.000	-1.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
0.000	1.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
1.000	2.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
2.000	3.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
3.000	4.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
4.000	5.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
5.000	6.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
6.000	7.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
7.000	8.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
8.000	9.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
9.000	10.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMIC PAGE  
 VALUE 10 10 10 0 0 5 5 5 0 0 0 0 0 0 0 0 0 1 1 2 ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 11

X	Y	Z	X(1)/C	X(2)/C	X(3)/C	X(4)/C	X(5)/C	X(6)/C	X(7)/C	X(8)/C	X(9)/C	X(10)/C
.0000	.0000	.0000	.0000	1.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
X	Y	Z	Z(1)/C	Z(2)/C	Z(3)/C	Z(4)/C	Z(5)/C	Z(6)/C	Z(7)/C	Z(8)/C	Z(9)/C	Z(10)/C
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	10.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMIC PAGE  
 VALUE 10 10 10 0 0 5 5 5 0 0 0 0 0 0 0 0 0 1 1 2 ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 13

J	K	XV	YV	ZV	1XV	1YV	1ZV	XN	YN	ZN	1XN	1YN	1ZN
25	3	2.000+00	-6.000+00	0.000	0.000	1.000+00	0.000	3.000+00	-5.000+00	0.000	0.000		
26	3	2.000+00	-4.000+00	0.000	0.000	1.000+00	0.000	3.000+00	-3.000+00	0.000	0.000	1.000+00	
27	3	2.000+00	-2.000+00	0.000	0.000	1.000+00	0.000	3.000+00	-1.000+00	0.000	0.000	1.000+00	
28	3	2.000+00	0.000	0.000	0.000	1.000+00	0.000	0.000	0.000	0.000	0.000	1.000+00	
29	3	2.000+00	2.000+00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000+00	
30	3	2.000+00	4.000+00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000+00	
31	3	2.000+00	6.000+00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000+00	
32	5	6.000+00	8.000+00	0.000	0.000	1.000+00	0.000	7.000+00	9.000+00	0.000	0.000	0.000	1.000+00

IEOF PLOT FILE 3>

LIFT DISTRIBUTION DETAIL-SURFACE NO.= 1/1 1, 2  
 \*\*\*\*\*

J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	V(X)	V(Y)	V(Z)	GAMA
1	1	-2.000	-9.000	.444	4.0000	2.7285	.17193	.00000	1.01942	.03461	-1.11482	.00172	-.2729+01
1	2	-0.000	-9.000	.734	4.0000	-.1951	.04557	.00000	.84616	+.13865	-.59122	.12807	.1951+00
1	3	2.000	-9.000	.667	4.0000	-.1.031	.03735	.00000	.81783	-.16698	-.76524	.13630	.1103+01

### 6.5 EXAMPLE PROBLEM # 4, THICK-WING ANALYSIS (CONTINUED)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20  
 VALUE 10.0 10.0 3.00 5.00 5.00 5.00 5.00 5.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 1.00 1.00 1.00 2.00  
 EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMIC PAGE 17  
 ALFA- 10.00 MACHNO- .0000 ALTITUDE-\*\*\*\*\*

→ LOWER SURFACE

**SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 1/4 1, 2**

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SLC/B	1XL	1VL	1ZL
6	.0500	1.000	.668	1.000	.9268	.1357	.8892	.1845	-.7111	.4446	.0574	.0000	-.9984
7	.1500	3.000	.668	3.000	.9469	.1384	.9085	.1885	-.6830	.4543	.0616	.0000	-.9981
8	.2500	5.000	.668	5.000	.9756	.1326	.9377	.1924	-.5930	.4689	.0690	.0000	-.9976
9	.3500	7.000	.668	7.000	.9878	.2213	.9344	.2100	-.4762	.4672	.1006	.0000	-.9949
10	.4500	9.000	.668	9.000	.6172	-.0015	.6081	.1059	-.0657	.3041	.1225	.0000	-.9925

UPPER SURFACE

SECTION AIRLOAD COEFFICIENTS-SURFACE NO. = 2/1 1, 2

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP	C/4	SCLC/B	1XL	1YL	1ZL
17	.0500	1.000	-.668	21.000	-.1651	.0921	-.1786	-.0127	.6512	-.0893	.0459	-.0000	.9989	
18	.1500	3.000	-.668	23.000	-.2141	.1103	-.2300	-.0180	.6162	-.1150	.0479	-.0000	.9989	
19	.2500	5.000	-.668	25.000	-.3032	.1480	-.3243	-.0270	.5209	-.1622	.0670	-.0000	.9978	
20	.3500	7.000	-.668	27.000	-.4921	.0645	-.4923	-.0777	.3681	-.2462	.0680	-.0000	.9977	
21	.4500	9.000	-.668	29.000	-.2507	.2142	-.2841	-.0063	.1903	-.1421	.2801	-.0000	.9600	

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS.= 1 - 2

E	ECN	ECX	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	.8909*	.1253	.0000	.8556	.2781	-.5014	-.0000	.0000	.00	.73	200.00	10.00	20.00
1	-.0003*	.0003*	.0000*	.0002*	.0003*	.0001*	.0000*	.0000*	.00*	.73*	200.00*	10.00*	20.00*
2	-.2850	.1218	.0000	-.3019	.0705	.4645	-.0000	.0000	.00	-.73	200.00	10.00	20.00
2	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.00*	-.73*	200.00*	10.00*	20.00*

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMI PAGE  
 VALUE 10 10 10 0 0 5 5 5 0 0 0 0 0 0 0 0 0 0 1 1 2 ALFA= 10.00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 18

EX-LATTICE SOLUTIONS FOR THICK WING (1,8)

$$= -0.5537, \quad C_D = 0.3485, \quad C_{M_{(0,1)}} = -0.0371$$

AC	.6058	.2471	.0000	.5537	.3485	-.0190	-.0000	.0000	.00	.73	200.00	10.00	20.00
CG	.6058	.2471	.0000	.5537	.3485	-.0371	-.0000	.0000	.00	.00	200.00	10.00	20.00
AC	.0003*	.0003*	.0000*	.0002*	.0003*	.0001*	.0000*	.0000*	.00*	.73*	200.00*	10.00*	20.00*
CG	.0003*	.0003*	.0000*	.0002*	.0003*	.0001*	.0000*	.0000*	.00*	.00*	200.00*	10.00*	20.00*

\* DETERMINANT= .4360423 \* SCALE= .6619-01

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20  
 VALUE 10 10 10 0 0 5 5 5 0 0 0 0 0 0 0 0 0 0 1 1 2  
 EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMIC PAGE  
 ALFA= 10.00 MACHND= .0000 ALTITUDE=\*\*\*\*\* 19

## SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 3/1 3, 3

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP	C/4	SLC/B	1XL	1YL	1ZL
28	.0500	1.000	.000	41.000	.5577	-.0519	.5583	.0878	.0031	.2791	-.0090	.0000	-1.0000	
29	.1500	3.000	.000	43.000	.3416	-.0491	.5419	.0855	.0029	.2710	-.0066	.0000	-1.0000	
30	.2500	5.000	.000	45.000	.5067	-.0426	.5064	.0806	.0014	.2532	-.0080	.0000	-1.0000	
31	.3500	7.000	.000	47.000	.4437	-.0301	.4622	.0716	-.0045	.2211	-.0071	.0000	-1.0000	
32	.4500	9.000	.000	49.000	.3261	-.0151	.3238	.0540	-.0191	.1619	-.0152	.0000	-.9999	

**INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS. # 3 - 3**

E	ECN	ECX	ECY	ECL	ECO	ECMP	ECMR	ECMY	EXA	EZA	E5	EMGC	EB
1	.0000	.0000	.0000	.0000	.0000	.0000	.0000*	.0000	.00	.73	200.00	10.00	20.00
1	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.00*	.73*	200.00*	10.00*	20.00*
2	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.00	-.73	200.00	10.00	20.00
2	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.00*	-.73*	200.00*	10.00*	20.00*
3	.4752	-.0378	.0000	.4745	.0453	-.0032	.0000	.0000	.00	.00	200.00	10.00	20.00
3	.0028*	.0028*	.0000	.0028*	.0000*	.0000*	.0000*	.0000*	.00*	.00	200.00*	10.00*	20.00*

\*\*\* AIRLOAD SUMS \*\*\*

\* DETERMINANT= -3470+12 \* SCALE= -9800-01 \* VORTEX-LATTICE SOLUTIONS FOR THIN WING (FLAT PLATE)

$$C_L = 0.4745, \quad C_{D_i} = 0.0453, \quad C_{M_{(C/4)}} = -0.0032$$

2024 RELEASE UNDER E.O. 14176

北京東方

QT TRWPLT OUTPUT OMITTED

#### 6.6 EXAMPLE PROBLEM # 5, DEBUG-PRINT OUTPUT OPTIONS

SUBSONIC-FLOW LIFTING SURFACE ANALYSIS PROGRAM HAD10B  
TRW SYSTEMS INC., HOUSTON OPERATIONS  
HOUSTON, TEXAS (77058)

\*\*\* JOBS INPUT LIST \*\*\*

```

7 XOT NSURF
EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 0
TASK 7-2, PROJECT 3303A, RJO 147035, AERODYNAMIC ANALYSIS AND DESIGN
SUBSONIC-FLOW LIFTING SURFACE ANALYSIS, TRW PRDGRAM NO, HA010B (NSURF)
A.V,GOMEZ/ 5 JULY 1972

$INPUT
NNGC=1,
NSS(1)=2, NC(1)=2, NFLG(1)=3, NFLG(6)=2, NFLG(11)=1,
X(1)=2*0., Y(1)=0., IO(1)=0., Z(1)=2*0., E(1)=2*0., C(1)=2*10.,
XCC(1)=0., FLAPDJ(1)= 10., NJOB=1, ALFA= 5, MACHN= 0., VSOLV=1,1,
NFLG(2)= 5,
SEND
EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 1
$INPUT
NFLG(20)= 1,
SEND
EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 2
$INPUT
NFLG(20)= 2,
SEND
EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 5
$INPUT
NFLG(20)= 5,
SEND
EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 8
$INPUT
NFLG(20)= 8,
SEND
EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 16
$INPUT
NFLG(20)= 16, NFLG(17)=1,
SEND
SENDJOBS
7 XOT NSURF

```

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 0 PAGE  
 VALUE 3 0 0 2 0 2 0 0 0 0 1 0 0 0 0 0 0 1 0 0 ALFA# .00 MACHNO# .0000 ALTITUDE\*\*\*\*\* 1

ORIGINAL PAGE IS  
OF POOR QUALITY

6.6 EXAMPLE PROBLEM # 5, DEBUG-PRINT OUTPUT OPTIONS (CONTINUED)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)\* 0 PAGE  
VALUE 3 0 0 0 0 2 0 0 0 0 1 0 0 0 0 0 0 1 0 0 ALFA= .00 MACHNO= ,0000 ALTITUDE\*\*\*\*\* 2

LIFTING SURFACE NO. 1  
\*\*\*\*\*

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
20.000	10.000	10.000	.0000	.0000	200.00	2.0000	10.000	10.000	5.000	,000	,000
FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	DEFLEC	DEFLEC	LAIL	RAIL	DIMED.	SWEET	NO. SPAN ELEMENTS	NO. CHORD ELEMENTS	NO. CHORD DISCONT.
,000 ,600	,000 1.000	,000 10.000	,000	,000	,000	,000	MGC/4 ,000	MGC/4 ,000	3	2	1
FUS STA X(CG)	WING STA Y(CG)	WL STA Z(CG)			AREA SICG)	CHORD C(CG)	SPAN B(CG)				
,000 ,000	,000 ,000	,000 ,000			1000.000	100.000	100.000				

WS	Y	Z	X(LC)	X(C/4)	X(TC)	TWIST	DIME(C/4)	SWEET(C/4)	C(WING)	C(FLAP)	C(TAB)
-10.000	-10.000	,000	-2.500	,000	7.500	,000	,000	,000	10.000	2.500	1.250
-9.000	-9.000	,000	-2.500	,000	7.500	,000	,000	,000	10.000	2.500	1.250
-8.000	-8.000	,000	-2.500	,000	7.500	,000	,000	,000	10.000	2.500	1.250
-7.000	-7.000	,000	-2.500	,000	7.500	,000	,000	,000	10.000	2.500	1.250
-6.000	-6.000	,000	-2.500	,000	7.500	,000	,000	,000	10.000	2.500	1.250
-5.000	-5.000	,000	-2.500	,000	7.500	,000	,000	,000	10.000	2.500	1.250
-4.000	-4.000	,000	-2.500	,000	7.500	,000	,000	,000	10.000	2.500	1.250
-3.000	-3.000	,000	-2.500	,000	7.500	,000	,000	,000	10.000	2.500	1.250
-2.000	-2.000	,000	-2.500	,000	7.500	,000	,000	,000	10.000	2.500	1.250
-1.000	-1.000	,000	-2.500	,000	7.500	,000	,000	,000	10.000	2.500	1.250
,000	,000	,000	-2.500	,000	7.500	,000	,000	,000	10.000	2.500	1.250
1.000	1.000	,000	-2.500	,000	7.500	,000	,000	,000	10.000	2.500	1.250
2.000	2.000	,000	-2.500	,000	7.500	,000	,000	,000	10.000	2.500	1.250
3.000	3.000	,000	-2.500	,000	7.500	,000	,000	,000	10.000	2.500	1.250
4.000	4.000	,000	-2.500	,000	7.500	,000	,000	,000	10.000	2.500	1.250
5.000	5.000	,000	-2.500	,000	7.500	,000	,000	,000	10.000	2.500	1.250
6.000	6.000	,000	-2.500	,000	7.500	,000	,000	,000	10.000	2.500	1.250
7.000	7.000	,000	-2.500	,000	7.500	,000	,000	,000	10.000	2.500	1.250
8.000	8.000	,000	-2.500	,000	7.500	,000	,000	,000	10.000	2.500	1.250
9.000	9.000	,000	-2.500	,000	7.500	,000	,000	,000	10.000	2.500	1.250
10.000	10.000	,000	-2.500	,000	7.500	,000	,000	,000	10.000	2.500	1.250

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)\* 0 PAGE  
VALUE 3 0 0 0 0 2 0 0 0 0 1 0 0 0 0 0 0 1 0 0 ALFA= .00 MACHNO= ,0000 ALTITUDE\*\*\*\*\* 3

X	Y	Z	XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C
,0000	,0000	,0000	1.0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000
,0000	10.0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000

SECTION AIRLOAD COEFFICIENTS-SURFACE NO. 1/( 1, 1)  
\*\*\*\*\*

J	Y+	Y-	Z	W	SCN	SCX	SCL	SC0	SMP Q/4	SCLC/B	1XL	1YL	1ZL
2	-,0000	-,000	,000	,000	,4870	,0062	,4846	,0430	-,1245	,2423	,0103	,0000	-,9999
3	,3333	,6667	,000	6.667	,3010	-,0247	,3020	,0241	,0141	,1510	,0038	-,0163	-,9999

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS. 1 + 1  
\*\*\*\*\*

E	ECN	ECX	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	Es	EMGC	EB
1	,3630	-,0144	,0000	,3629	,0173	-,0321	-,0000	-,0000	,00	,00	200.00	10.00	20.00
i	,0164*	,0164*	,0000*	,0149*	,0178*	,0041*	-,0000*	-,0000*	,00*	,00*	200.00*	10.00*	20.00*

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)\* 0 PAGE  
VALUE 3 0 0 0 0 2 0 0 0 0 1 0 0 0 0 0 0 1 0 0 ALFA= 5.00 MACHNO= ,0000 ALTITUDE\*\*\*\*\* 4

\*\*\* AIRLOAD SUMS \*\*\*

AC	,3630	-,0144	,0000	,3629	,0173	-,0321	-,0000	-,0000	,00	,00	200.00	10.00	20.00
CG	,3726	-,0029	,0000	,0726	,0035	-,0006	-,0000	-,0000	,00	,00	100.00	100.00	100.00
AC	,0164*	,0164*	,0000*	,0149*	,0178*	,0041*	-,0000*	-,0000*	,00*	,00*	200.00*	10.00*	20.00*
CG	,0033*	,0033*	,0000*	,0030*	,0036*	,0001*	-,0000*	-,0000*	,00*	,00*	100.00*	100.00*	100.00*

\* DETERMINANT= ,1073+02 \* SCALE= ,7042-01 \*

\*\*\* JOB TIME= 1 / ELAPSED TIME= 1 / NO.PLOT FILES= 0 / NSURF EXEC, VERSION 6-18-72 \*\*\*

\*\*\*\*\*

## 6.6 EXAMPLE PROBLEM # 5, DEBUG-PRINT OUTPUT OPTIONS (CONTINUED)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 1 PAGE  
VALUE 3 0 0 0 0 2 0 0 0 0 1 0 0 0 0 0 1 0 1

ALFA# ,00 MACHNO# ,0000 ALTITUDE\*\*\*\*\* 7

	XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C	
	,0000	1.0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	
X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000
,0000	10.0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000

J	K	V	Z	WL	EW	DWL	DC	DS
1	1	-6.667+00	0.000	6.667+00	6.667+00	6.667+00	7.500+00	5.000+01
2	1	-5.960-08	0.000	0.000	0.000	6.667+00	7.500+00	5.000+01
3	1	6.667+00	0.000	6.667+00	6.667+00	6.667+00	7.500+00	5.000+01
1	2	-6.667+00	0.000	6.667+00	6.667+00	6.667+00	2.500+00	1.667+01
2	2	-5.960-08	0.000	0.000	0.000	6.667+00	2.500+00	1.667+01
3	2	6.667+00	0.000	6.667+00	6.667+00	6.667+00	2.500+00	1.667+01

J	K	XV	YV	ZV	1XV	1YV	1ZV	XN	YN	ZN	1XN	1YN	1ZN
1	1	-6.250-01	-1.000+01	0.000	0.000	1.000+00	0.000	3,125+00	-6.667+00	0.000	0.000	0.000	1.000+00
2	1	-6.250-01	-3.333+00	0.000	0.000	1.000+00	0.000	3,125+00	-5.960-08	0.000	0.000	0.000	1.000+00
3	1	-6.250-01	3.333+00	0.000	0.000	1.000+00	0.000	3,125+00	6.667+00	0.000	0.000	0.000	1.000+00
1	2	5.625+00	-1.000+01	0.000	0.000	1.000+00	0.000	6,875+00	-6.667+00	0.000	0.000	0.000	1.000+00
2	2	5.625+00	-3.333+00	0.000	0.000	1.000+00	0.000	6,875+00	-5.960-08	0.000	0.000	0.000	1.000+00
3	2	5.625+00	3.333+00	0.000	0.000	1.000+00	0.000	6,875+00	6.667+00	0.000	0.000	0.000	1.000+00

SECTION AIRLOAD COEFFICIENTS-SURFACE NO. # 1/( 1, 1)  
\*\*\*\*\*

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
2	-0.0000	-0.000	.000	,000	,4870	,0062	,4846	,0430	,1245	,2423	,0103	,0000	,9999
3	,3333	6.667	,000	6.667	,3010	-,0247	,3020	,0241	,0141	,1510	,0038	,0163	,9999

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 1 PAGE  
VALUE 3 0 0 0 0 2 0 0 0 0 1 0 0 0 0 0 1 0 1

ALFA# 5.00 MACHNO# ,0000 ALTITUDE\*\*\*\*\* 8

INTEGRATED AERLOAD COEFFICIENTS-SURFACE NOS. # 1 - 1  
\*\*\*\*\*

E	EDN	ECX	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	,3630	-,0144	,0000	,3629	,0173	-,0321	-,0000	-,0000	,00	,00	200.00	10.00	20.00
1	,1164*	,0164*	,0000*	,0149*	,0178*	,0041*	-,0000*	-,0000*	,00*	,00*	200.00*	10.00*	20.00*
*** AIRLOAD SUMS ***													
AC	,3630	-,0144	,0000	,3629	,0173	-,0321	-,0000	-,0000	,00	,00	200.00	10.00	20.00
CG	,1726	-,0029	,0000	,0726	,0035	-,0006	-,0000	-,0000	,00	,00	1000.00	100.00	100.00
AC	,1164*	,0164*	,0000*	,0149*	,0178*	,0041*	-,0000*	-,0000*	,00*	,00*	200.00*	10.00*	20.00*
CG	,1033*	,0153*	,0000*	,0030*	,0036*	,0001*	-,0000*	-,0000*	,00*	,00*	1000.00*	100.00*	100.00*

\* DETERMINANT= ,1073+02 \* SCALE= ,7042-01 \*

\*\*\* JOB TIME= 1 / ELAPSED TIME= 2 / NO.PLOT FILES= 0 / NSURF EXEC, VERSION 6-18-72 \*\*\*

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 2 PAGE  
VALUE 3 0 0 0 0 2 0 0 0 0 1 0 0 0 0 0 1 0 2

ALFA# ,00 MACHNO# ,0000 ALTITUDE\*\*\*\*\* 11

	XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C	
	,0000	1.0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	
X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000
,0000	10.0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000

J	K	V	Z	WL	EW	DWL	DC	DS
1	1	-6.667+00	0.000	6.667+00	6.667+00	6.667+00	7.500+00	5.000+01
2	1	-5.960-08	0.000	0.000	0.000	6.667+00	7.500+00	5.000+01
3	1	6.667+00	0.000	6.667+00	6.667+00	6.667+00	7.500+00	5.000+01

ORIGINAL PAGE IS  
OF POOR QUALITY

## 6.6 EXAMPLE PROBLEM # 5, DEBUG-PRINT OUTPUT OPTIONS (CONTINUED)

1	2	-6.667e+00	0.000	6.667e+00	6.667e+00	6.667e+00	2.300e+00	1.667e+01
2	2	-5.960e-08	0.000	0.000	0.000	6.667e+00	2.500e+00	1.667e+01
3	2	6.667e+00	0.000	6.667e+00	6.667e+00	6.667e+00	2.500e+00	1.667e+01

J	K	xV	yV	zV	1xV	1yV	1zV	xN	yN	zN	iXN	iYN	iZN
1	1	-6.250-01	-1.000+01	0.000	0.000	1.000+00	0.000	3,125+00	-6,667+00	0.000	0.000	0.000	1.000+00
2	1	-6.250-01	-3.333+00	0.000	0.000	1.000+00	0.000	3,125+00	-3,960-08	0.000	0.000	0.000	1.000+00
3	1	-6.250-01	3.333+00	0.000	0.000	1.000+00	0.000	3,125+00	4,667+00	0.000	0.000	0.000	1.000+00
1	2	5.625+00	-1.000+01	0.000	0.000	1.000+00	0.000	6,875+00	-6,667+00	0.000	0.000	0.000	1.000+00
2	2	5.625+00	-3.333+00	0.000	0.000	1.000+00	0.000	6,875+00	-3,960-08	0.000	0.000	0.000	1.000+00
3	2	5.625+00	3.333+00	0.000	0.000	1.000+00	0.000	6,875+00	4,667+00	0.000	0.000	0.000	1.000+00

LIFT DISTRIBUTION DETAIL-SURFACE NO.= 1/( 1, 1 )

J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	VI(X)	VI(Y)	VI(Z)	GAMA
1	1	.625	.667	.000	50,0000	.3925	.08384	.00000	.99873	.00054	.00368	.00332	.1472e01
1	2	.625	.667	.054	14,4467	.0302	.00380	.01627	.99893	.00027	.00472	.00480	.3748e01

SECTION AIRLOAD COEFFICIENTS-SURFACE NO. 1/1 1, 1)

J	Y*	Y	Z	W	SCN	SCX	SCW	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
2	-,.0000	-,000	,000	,000	,4870	,0062	,4846	,0430	-,1245	,2423	,0103	,0000	-,9999
3	-.3333	6.667	,000	6.667	,3010	-,0247	,3020	,0241	,0341	,1310	,0038	-,0163	-,9999

**INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS. 1 - 1**

E	ECN	ECX	ECY	ECL	ECD	ECMP	ECMR	ECHY	EXA	EZA	ES	EMGC	EB
1	.3630	-.0144	.0000	.3629	.0173	-.0321	-.0000	-.0000	.00	.00	200.00	10.00	20.00
1	.0164*	.0164*	.0000*	.0149*	.0178*	.0041*	-.0000*	-.0000*	.00*	.00*	200.00*	10.00*	20.00*
*** AIRLOAD SUMS ***													
AC	.3630	-.0144	.0000	.3629	.0173	-.0321	-.0000	-.0000	.00	.00	200.00	10.00	20.00
CG	.0726	-.0029	.0000	.0726	.0035	-.0006	-.0000	-.0000	.00	.00	1000.00	100.00	100.00
AC	.0164*	.0164*	.0000*	.0149*	.0178*	.0041*	-.0000*	-.0000*	.00*	.00*	200.00*	10.00*	20.00*
CG	.0033*	.0033*	.0000*	.0033*	.0034*	.0001*	-.0000*	-.0000*	.00*	.00*	100.00*	10.00*	10.00*

DETERMINANTS 1073403 A SCALERS 2042-01 8

\*\*\*\*\* JOB\_TIMER 1-4 ELAPSED TIME\* 3-4 NO PBLT FILER 9-4 NSURE EXEC VERSION 6-14-72 \*\*\*\*

[View Details](#) | [Edit](#) | [Delete](#)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE NO.5 - DEBUG+DUMP DEMONSTRATION; NFLG(20)\* 5 PAGE  
 VALUE 3 0 0 0 2 0 0 0 0 1 0 0 0 0 0 0 1 0 5 ALFA# ,00 MACHNO# ,0000 ALTITUDE\*\*\*\*\* 15

J	K	Y	Z	WL	EW	DWL	OC	OS
1	1	-6.667+00	0.000	6.667+00	6.667+00	6.667+00	7.500+00	5.000+01
2	1	-5.960-00	0.000	0.000	0.000	6.667+00	7.500+00	5.000+01
3	1	6.667+00	0.000	6.667+00	6.667+00	6.667+00	7.500+00	5.000+01
1	2	-6.667+00	0.000	6.667+00	6.667+00	6.667+00	2.500+00	1.667+01
2	2	-5.960-00	0.000	0.000	0.000	6.667+00	2.500+00	1.667+01
3	2	6.667+00	0.000	6.667+00	6.667+00	6.667+00	2.500+00	1.667+01

6.6 EXAMPLE PROBLEM # 5, DEBUG-PRINT OUTPUT OPTIONS (CONTINUED)

J	K	XV	YV	ZV	1XV	1YV	1ZV	XN	YN	ZN	iXN	iYN	iZN
1	1	-6.250-01	-1.000+01	0.000	0.000	1.000+00	0.000	3.125+00	-6.667+00	0.000	0.000	0.000	1.000+00
2	1	-6.250-01	-3.333+00	0.000	0.000	1.000+00	0.000	3.125+00	-5.980-08	0.000	0.000	0.000	1.000+00
3	1	-6.250-01	3.333+00	0.000	0.000	1.000+00	0.000	3.125+00	6.667+00	0.000	0.000	0.000	1.000+00
1	2	5.625+00	-1.000+01	0.000	0.000	1.000+00	0.000	6.875+00	-6.667+00	0.000	0.000	0.000	1.000+00
2	2	5.625+00	-3.333+00	0.000	0.000	1.000+00	0.000	6.875+00	-5.980-08	0.000	0.000	0.000	1.000+00
3	2	5.625+00	3.333+00	0.000	0.000	1.000+00	0.000	6.875+00	6.667+00	0.000	0.000	0.000	1.000+00

VORTEX LATTICE MATRIX DETAIL-SURFACE NO.= 1/( 1, 1)

J	K	NP	NG	VFS(MAT)	VIN(MAT)	P(X)	P(Y)	P(Z)	B(X)	B(Y)	B(Z)	D(X)	D(Y)	D(Z)
2	1	1	1	-.8716-01	.1113+00	.3125+01	-.5960-07	.0000	-.6250+00	.3333+01	.0000	-.6250+00	.3333+01	.0000
2	1	2	1	-.8716-01	.3010-01	.3125+01	-.5960-07	.0000	-.6250+00	.3333+01	.0000	-.6250+00	.1000+02	.0000
2	1	1	3	-.8716-01	.2476-01	.3125+01	-.5960-07	.0000	.5616+01	.3333+01	.1085+00	.5616+01	.3333+01	.1085+00
2	1	1	4	-.8716-01	.6688+01	.3125+01	-.5960-07	.0000	.5616+01	.3333+01	.1085+00	.5625+01	.1000+02	.0000
3	1	2	1	-.8716-01	.2505+01	.3125+01	.6667+01	.0000	-.6250+00	.3333+01	.0000	-.6250+00	.3333+01	.0000
3	1	2	2	-.8716-01	.1072+00	.3125+01	.6667+01	.0000	-.6250+00	.3333+01	.0000	-.6250+00	.1000+02	.0000

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 5 PAGE  
VALUE 3 0 0 0 2 0 0 0 0 1 0 0 0 0 0 1 0 5 ALFA= 5.00 MACHNO= .0000 ALTITUDE\*\*\*\*\* 16

J	K	NP	NG	VFS(MAT)	VIN(MAT)	P(X)	P(Y)	P(Z)	B(X)	B(Y)	B(Z)	D(X)	D(Y)	D(Z)
3	1	2	3	-.8716-01	.3346+01	.3125+01	.6667+01	.0000	.5616+01	.3333+01	.1085+00	.5616+01	.3333+01	.1085+00
3	1	2	4	-.8716-01	.2002+01	.3125+01	.6667+01	.0000	.5616+01	.3333+01	.1085+00	.5625+01	.1000+02	.0000
2	2	3	1	-.2588+00	.9435+01	.6847+01	-.5960-07	.3250+00	-.6250+00	.3333+01	.0000	-.6250+00	.3333+01	.0000
2	2	3	2	-.2588+00	.5275+01	.6847+01	-.5960-07	.3250+00	-.6250+00	.3333+01	.0000	-.6250+00	.1000+02	.0000
2	2	3	3	-.2588+00	.1814+00	.6847+01	-.5960-07	.3250+00	.5616+01	.3333+01	.1085+00	.5616+01	.3333+01	.1085+00
2	2	3	4	-.2588+00	.3772+01	.6847+01	-.5960-07	.3250+00	.5616+01	.3333+01	.1085+00	.5625+01	.1000+02	.0000
3	2	4	1	-.8716-01	.2831-01	.6875+01	.6667+01	.0000	-.6250+00	.3333+01	.0000	-.6250+00	.3333+01	.0000
3	2	4	2	-.8716-01	.9421+01	.6875+01	.6667+01	.0000	-.6250+00	.3333+01	.0000	-.6250+00	.1000+02	.0000
3	2	4	3	-.8716-01	.1977+01	.6875+01	.6667+01	.0000	.5616+01	.3333+01	.1085+00	.5616+01	.3333+01	.1085+00
3	2	4	4	-.8716-01	.1795+00	.6875+01	.6667+01	.0000	.5616+01	.3333+01	.1085+00	.5625+01	.1000+02	.0000

LIFT DISTRIBUTION DETAIL-SURFACE NO.= 1/( 1, 1)

J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	VI(X)	VI(Y)	VI(Z)	GAMA
1	1	-.625	-6.667	.000	50.0000	.3925	.08384	.00000	.99673	.00054	.00568	.00332	*.1472*01
1	2	5.620	-6.667	.054	16.6667	.0302	+.00380	-.01627	.99893	.00287	+.00472	.09088	-.3780*01
2	1	-.625	-.000	.000	50.0000	.3178	-.01521	.00000	1.00160	.00541	.00000	.10236	-.1192*01
2	2	5.616	-.000	.109	16.6667	.9942	-.01031	.00000	.99872	.00253	.00000	.09747	*.1243*01
3	1	-.625	6.667	.000	50.0000	.3925	.08384	.00000	.99673	.00054	.00568	.00332	*.1472*01
3	2	5.620	6.667	.054	16.6667	.0302	+.00380	-.01627	.99893	.00287	+.00472	.09088	-.3780*01

SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 1/( 1, 1)

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP	C/4	SLC/B	1XL	1YL	1ZL
2	-.0000	-,000	,000	,000	.4870	.0062	.4846	,0430	-,1245	,2423	,0183	,0000	-,9999	
3	.3333	6.667	,000	6.667	.3010	-,0247	,3020	,0241	,0141	,1510	,0038	-,0163	-,9999	

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 5 PAGE  
VALUE 3 0 0 0 2 0 0 0 0 1 0 0 0 0 0 1 0 5 ALFA= 5.00 MACHNO= .0000 ALTITUDE\*\*\*\*\* 17

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NO.5 = 1 - 1

E	ECX	ECY	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	.3630	-,0144	,0030	.3629	,0173	-,0321	-,0000	-,0000	,00	,00	200.00	10.00	20.00
1	-,0164*	,0164*	,0030*	,0149*	,0178*	,0041*	-,0000*	,0000*	,00*	,00*	200.00*	10.00*	20.00*
*** AIRLOAD SUMS ***													
AC	,3630	-,0144	,0000	,3629	,0173	-,0321	-,0000	-,0000	,00	,00	200.00	10.00	20.00
CG	,0276	-,0029	,0030	,0726	,0035	-,0006	-,0000	-,0000	,00	,00	1000.00	100.00	100.00
AC	,0164*	,0164*	,0030*	,0149*	,0178*	,0041*	-,0000*	-,0000*	,00*	,00*	200.00*	10.00*	20.00*
CG	,0033*	,0033*	,0030*	,0030*	,0036*	,0001*	-,0000*	-,0000*	,00*	,00*	1000.00*	100.00*	100.00*

\* DETERMINANT= ,1073+02 \* SCALE= ,7042-01 \*

\*\*\*\* JOB TIME= 1 / ELAPSED TIME= 4 / NO.PLOT FILESF= 0 / NSURF EXEC. VERSION 6-18-72 \*\*\*\*  
\*\*\*\*\*

ORIGINAL FL31...  
OF POOR QUALITY

## 6.6 EXAMPLE PROBLEM # 5, DEBUG-PRINT OUTPUT OPTIONS (CONTINUED)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE NO.5 - DEBUG=DUMP DEMONSTRATION NFLG(20)= 8 PAGE  
VALUE 3 0 0 0 0 2 0 0 0 0 1 0 0 0 0 0 0 1 0 8 ALFAS ,00 MACHND= ,0000 ALTITUDE\*\*\*\*\* 20

	XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C	
	,0000	1.0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	
X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	
,0000	10.0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	

J	K	Y	Z	WL	EW	DWL	DC	DS	
1	1	-6.667+00	0.000	6.667+00	6.667+00	6.667+00	7.000+00	5.000+01	
2	1	-5.960-08	0.000	0.000	0.000	0.000	6.667+00	7.000+00	5.000+01
3	1	6.667+00	0.000	6.667+00	6.667+00	6.667+00	7.000+00	5.000+01	
1	2	-6.667+00	0.000	6.667+00	6.667+00	6.667+00	2.000+00	1.667+01	
2	2	-5.960-08	0.000	0.000	0.000	0.000	6.667+00	2.000+00	1.667+01
3	2	6.667+00	0.000	6.667+00	6.667+00	6.667+00	2.000+00	1.667+01	

J	K	XV	YY	ZV	1XV	1YY	1ZV	XN	YN	ZN	1XN	1YN	1ZN
1	1	-6.250-01	-1.000+01	0.000	0.000	1.000+00	0.000	3.125+00	-6.667+00	0.000	0.000	0.000	1.000+00
2	1	-6.250-01	-3.333+00	0.000	0.000	1.000+00	0.000	3.125+00	-5.960-08	0.000	0.000	0.000	1.000+00
3	1	-6.250-01	3.333+00	0.000	0.000	1.000+00	0.000	3.125+00	6.667+00	0.000	0.000	0.000	1.000+00
1	2	5.625+00	-1.000+01	0.000	0.000	1.000+00	0.000	6.875+00	-6.667+00	0.000	0.000	0.000	1.000+00
2	2	5.625+00	-3.333+00	0.000	0.000	1.000+00	0.000	6.875+00	-5.960-08	0.000	0.000	0.000	1.000+00
3	2	5.625+00	3.333+00	0.000	0.000	1.000+00	0.000	6.875+00	6.667+00	0.000	0.000	0.000	1.000+00

```
$DBUGV1
P     =   .31250000E+01,   -.59604645E-07,   .00000000E+00,
B     =   -.62500000E+00,   -.33333333E+01,   .00000000E+00,
D     =   -.62500000E+00,   .33333332E+01,   .00000000E+00,
TANA  =   -.43660927E-01,
GAMA  =   .79577538E-01,
PSIF  =   .34891974E+01,
VCOS  =   .15201368E+00,   -.17101539E+00,   .34816869E+01,
SEND
$DBUGV2
PSIF  =   -.34891974E+01,
VCOS  =   .30402735E+00,   .00000000E+00,   .69633738E+01,
SEND
```

```
$DBUGV3
PSIF  =   .23621825E+01,
VCOS  =   .30402735E+00,   .00000000E+00,   .93255563E+01,
SEND
VORTEX LATTICE MATRIX DETAIL-SURFACE NO.= 1/( 1, 1)
*****
```

J	K	NP	NC	VFS(MAT)	VIN(MAT)	P(X)	P(Y)	P(Z)	B(X)	B(Y)	B(Z)	D(X)	D(Y)	D(Z)
2	1	1	1	-.8716-01	,1113+00	,3125+01	-,5960-07	,0000	-,6250+00	-,3333+01	,0000	-,6250+00	,3333+01	,0000

```
$DBUGV1
P     =   .31250000E+01,   -.59604645E-07,   .00000000E+00,
B     =   -.62500000E+00,   -.10000000E+02,   .00000000E+00,
D     =   -.62500000E+00,   -.33333333E+01,   .00000000E+00,
TANA  =   -.43660927E-01,
GAMA  =   .79577538E-01,
PSIF  =   .90046574E+00,
VCOS  =   .3926978E-01,   -.14726204E-01,   .89942843E+00,
SEND
$DBUGV2
PSIF  =   -.34891976E+01,
VCOS  =   -.11274381E+00,   .15628920E+00,   -.25822587E+01,
SEND
$DBUGV3
PSIF  =   .48349399E+00,
VCOS  =   -.11274381E+00,   .15628920E+00,   -.20987647E+01,
SEND
```

```
$DBUGV1
P     =   .31250000E+01,   -.59604645E-07,   .00000000E+00,
B     =   -.62500000E+00,   -.10000000E+02,   .00000000E+00,
D     =   -.62500000E+00,   -.33333333E+01,   .00000000E+00,
TANA  =   -.43660927E-01,
GAMA  =   .79577538E-01,
PSIF  =   .90046574E+00,
VCOS  =   .3926978E-01,   -.14726204E-01,   .89942843E+00,
SEND
$DBUGV2
PSIF  =   -.34891976E+01,
VCOS  =   -.11274381E+00,   .15628920E+00,   -.25822587E+01,
SEND
$DBUGV3
PSIF  =   .48349399E+00,
VCOS  =   -.11274381E+00,   .15628920E+00,   -.20987647E+01,
SEND
```

#### 6.6 EXAMPLE PROBLEM # 5. DEBUG-PRINT OUTPUT OPTIONS (CONTINUED)

PSIF = .46490990E-02,  
 VC05 = -.70147156E-02, - .49002358E-02, -.26632830E+00,

```

$DBUGV1 =
P = .56202524E+01, .66666664E+01, .54263035E-01,
S = .56155049E+01, -.33333333E+01, .10853007E+00,
D = .56155049E+01, .33333332E+01, .10853007E+00,
TANA = .4366292E-01,
GAMA = .79577538E-01,
PSIF = .66713168E+00,
VCOS = .29099439E-01, .36028789E-02, .66648699E+00,
SEND

$DBUGV2
PSIF = -.70040095E+01,
VCOS = -.58302715E-01, -.28861600E-01, -.13353522E+01,
SEND

$DBUGV3
PSIF = .14523004E-01,
VCOS = -.43835899E-01, -.28861600E-01, -.13340865E+01,
SEND

```

```

$BUGV1
P   = .56202524E+01, .66666664E+01, .54265035E+01,
B   = .56155049E+01, .33333332E+01, .10851007E+00,
D   = .56250000E+01, .99999996E+01, .00000000E+00,
TANA = -43660927E-01,
GAMA = .79575536E-01,
PSIF = .20042719E+01,
VC05 = .87413603E-01, .32468731E-01, .20021014E+01,
SEND
$BUGV2
PSIF = -.20042719E+01,
VC05 = .17402721E+00, .64937482E-01, .40042028E+01,
SEND
$BUGV3
PSIF = .00050000E+00,
VC05 = .074802731E+00, .14977442E-01, .10012121E-01

```

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LIFT DISTRIBUTION DETAIL-SURFACE NO. = 1/( 1, 1)

J	K	P(X)	P(Y)	P(Z)	AHEA	CPN	G(X)	G(Y)	G(Z)	Vl(X)	Vl(Y)	Vl(Z)	GAMA
1	1	-6.623	-6.667	.000	50,0000	.3925	.00384	.00000	.99673	.00054	.00568	.00332	.1472+01
1	2	5.620	-6.667	.054	16,6667	.0302	-.00380	-.01427	.99893	.00287	.00472	.09088	-.3780+01

JOBFLAG VALUE		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 8 PAGE 21		
		3	0	C	U	0	2	0	0	0	0	1	0	0	0	0	0	0	1	0	8	ALFA= 5,00 MACHNO=.0000 ALTITUDE=====		
J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	V(X)	V(Y)	V(Z)	GAMA											
2	1	.625	.300	.000	50,0000	.3178	.01521	.00000	.000160	.00541	.00000	.10236	.119201											
2	2	5.616	.300	.109	16,6667	.9942	.01031	.00000	.99872	.00253	.00000	.09747	.124301											
3	1	.625	6.667	.000	50,0000	.3925	.00384	.00000	.99673	.00054	.000568	.00332	.147201											
3	2	5.620	6.667	.054	16,6667	.0302	.00380	.01527	.99893	.00287	.00472	.09048	.127801											

SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 1/{ 1, 10 }

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SLC/B	1XL	1YL	1ZL
2	-,.9000	-,3300	,000	,000	.4870	,0062	,4846	,0430	-,1245	,2423	,0103	,0000	-,9999
3	,3333	6,667	,000	6,667	,3010	-,0247	,3020	,0241	,0141	,1510	,0018	-,0153	-,9999

**INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS. # 1 - 1**

E	ECN	ECX	ECY	ECL	ECO	ECMP	ECMR	ECMY	EXA	EZA	ES	EMCC	EB
1	.3630	-.0144	.0000	.3629	.0173	-.0321	-.0000	-.0000	.00	.00	200.00	10.00	20.00
1	.0164*	.0164*	.0000*	.0149*	.0178*	.0041*	-.0000*	.0000*	.00*	.00*	200.00*	10.00*	20.00*
*** AIRLOAD SUMS ***													
AC	.3630	-.0144	.0000	.3629	.0173	-.0321	-.0000	-.0000	.00	.00	200.00	10.00	20.00
CG	-.0726	-.0129	.0000	.0726	.0035	-.0006	-.0000	-.0000	.00	.00	1000.00	100.00	100.00
AC	.0164*	.0164*	.0000*	.0149*	.0178*	.0041*	-.0000*	.0000*	.00*	.00*	200.00*	10.00*	20.00*
CG	-.0370*	.0733*	.0000*	.0030*	.0036*	-.0000*	-.0000	-.0000	.00*	.00*	1000.00*	100.00*	100.00*

\* DETERMINANT= .1073+02 \* SCALE= .7042-01 \*

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20    EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(2D)\* 8    PAGE  
 VALUE 3 0 0 2 0 2 0 0 0 1 0 0 0 0 0 0 0 1 0 8    ALFA= 5,00 MACHNO= ,0000 ALTITUDE\*\*\*\*\*    22

\*\*\* JOB TIME= 3 / ELAPSED TIME= 7 / NO.PLOT FILES= 0 / NSURF EXEC, VERSION 6-18-72 \*\*\*

## 6.6 EXAMPLE PROBLEM # 5, DEBUG-PRINT OUTPUT OPTIONS (CONTINUED)

EXAMPLE NO. 5 - DEBUG-DUMP DEMONSTRATION NPLC(RU)P 16 PAGE 25  
 ALFAP .000 MACMNO .0000 ALTITUDE-----

J	K	Y	Z	WL	EW	DWL	DC	DS
1	1	-6.667+00	0.000	6.667+00	6.667+00	6.667+00	7.500+00	5.000+00
2	1	-5.960-08	0.000	0.000	0.000	6.667+00	7.500+00	5.000+00
3	1	6.667+00	0.000	6.667+00	6.667+00	6.667+00	7.500+00	5.000+00
1	2	-6.667+00	0.000	6.667+00	6.667+00	6.667+00	2.500+00	1.667+00
2	2	-5.960-08	0.000	0.000	0.000	6.667+00	2.500+00	1.667+00
3	2	6.667+00	0.000	6.667+00	6.667+00	6.667+00	2.500+00	1.667+00

J	K	XV	YV	ZV	1XV	1YV	1ZV	XN	YN	ZN	1XN	1YN	1ZN
1	1	-6,250-01	-1,000+01	0,000	0,000	1,000+00	0,000	3,125+00	-6,667+00	0,000	0,000	0,000	1,000+00
2	1	-6,250-01	-3,333+00	0,000	0,000	1,000+00	0,000	3,125+00	-5,960-08	0,000	0,000	0,000	1,000+00
3	1	-6,250-01	3,333+00	0,000	0,000	1,000+00	0,000	3,125+00	6,667+00	0,000	0,000	0,000	1,000+00
1	2	5,625+00	-1,000+01	0,000	0,000	1,000+00	0,000	6,875+00	-6,667+00	0,000	0,000	0,000	1,000+00
2	2	5,625+00	-3,333+00	0,000	0,000	1,000+00	0,000	6,875+00	-5,960-08	0,000	0,000	0,000	1,000+00
3	2	5,625+00	3,333+00	0,000	0,000	1,000+00	0,000	6,875+00	6,667+00	0,000	0,000	0,000	1,000+00

```

$DEBUGV1      .31250000E+01,   -.59604645E-07,   .00000000E+00,
P             -.62500000E+00,   -.33333333E+01,   .00000000E+00,
B             -.62500000E+00,   .33333332E+01,   .00000000E+00,
D             .43661927E-01,
TANA          .79577538E-01,
GAMA          .34891974E+01,
PSIF          .15201386E+00,   -.17101539E+00,   .34816869E+01,
VCOS          .69633738E+01,
SEND          .00000000E+00,
$DEBUGV2      -.34891974E+01,
PSIF          .30402735E+00,   .00000000E+00,   .69633738E+01,
VCOS          .00000000E+00,
SEND          .00000000E+00,

```

**\$DBUGV3**  
**PSIF** = .23621825E+01,  
**VSOF** = .32402735E+00, .00000000E+00, .93255563E+01,

ABOUT 50 PAGES OF OUTPUT OMITTED

CUSR .1998399471E-007  
 SEND  
 SREFLEX  
 PX .19923998E+05,  
 PY .17423248E+04,  
 X1 .10038198E+05,  
 Y1 .0000000DE+00,  
 PHI -.87266430E-01,  
 ALFAR .87266430E-01,  
 RX .10020052E+05,  
 RY .87429012E+01,  
 ZL .10000000E+00  
 COSR  
 SEND  
 END  
 INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS. 1 - 1  
 \*\*\*\*  
 ECN ECX ECY ECL ECD ECMR ECMY EXA EZB ES EMGC EB  
 1 .3630 -.0144 .0000 .3629 .0173 -.0321 -.0000 -.0000 .00 .00 200.00 10.00 20.00  
 2 .0144 .0144 .0000 .0149 .0178 .0041 -.0000\*.0000\*.0000\*.0000\*.0000\*.0000\*.0000\*

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS. 1 - 1

1	.3630	-.0144	.0000	.3629	.0173	-.0321	-.0000	-.0000	.00	.00	200.00	10.00	20.00
1	.0164*	.0164*	.0000*	.0149*	.0178*	.0041*	-.0000*	.0000*	.00*	.00*	200.00*	10.00*	20.00*
*** AIRLOAD SUMS ***													
AC	.3630	-.0144	.0000	.3629	.0173	-.0321	-.0000	-.0000	.00	.00	200.00	10.00	20.00
CG	.0164*	.0164*	.0000*	.0149*	.0178*	.0041*	-.0000*	.0000*	.00*	.00*	100.00	100.00	100.00
AC	.0164*	.0164*	.0000*	.0149*	.0178*	.0041*	-.0000*	.0000*	.00*	.00*	200.00*	10.00*	20.00*
CG	.0033*	.0033*	.0000*	.0030*	.0036*	.0001*	-.0000*	.0000*	.00*	.00*	100.00	100.00	100.00*

\* DETERMINANT = .1073+02 \* SCALE = 7042-01 \*

JDBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)\* 16 PAGE  
 VALUE 3 0 0 0 0 2 0 0 0 0 1 0 0 0 0 0 1 1 0 16 ALFA= 5,00 MACHNO= ,0000 ALTITUDE===== 27

DATE: 109-TIME= 6 / ELAPSED TIME= 13 / ND-PLT FILES= 0 / NSURF EXEC. VERSION 6-18-72 \*\*\*\*

## 6.6 EXAMPLE PROBLEM # 5, DEBUG-PRINT OUTPUT OPTIONS (CONTINUED)

XQT NSURFT 24 AUG 72 10°20' 3.974

1.032000+00	7.680000+00	3.030000+00	-2.930000+00	-9.780000-02	TEST MATRIX = [M]
7.865000+00	-6.390000+00	-3.380000+00	5.670000+00	7.103000+00	
3.216000+00	8.900000+00	-1.167000+01	8.323000+00	9.992000+00	
3.031000+00	-1.030000+00	4.180000+00	9.073000+00	9.783000-01	
1.032000+01	5.690000+00	-3.600000+00	3.780000-02	1.514000+01	
3.220950-01	2.931715-01	9.4424216-03	-8.727428-02	-1.363442-01	INVERSE MATRIX = [M] <sup>-1</sup>
1.081531-01	1.615780-03	3.541707-02	1.522940-03	-2.353400-02	
-8.700874-02	-1.258476-01	-6.201933-02	1.070551-01	9.242558-02	
-2.496730-02	-1.494837-02	3.317090-02	8.115159-02	-2.028226-02	
-2.808256-01	-2.303324-01	-3.56437-02	8.417013-02	1.895721-01	
1.000000+00	-3.469447-18	4.336809-19	-1.782157-18	3.469447-18	UNIT MATRIX = [M] x [M] <sup>-1</sup>
-8.673617-19	1.000000+00	1.734723-18	-1.029992-18	-8.673617-19	
0.000000	8.673617-19	1.000000+00	-2.463172-18	-1.734723-18	
4.336809-19	9.757820-19	0.000000	1.000000+00	1.301043-18	
3.469447-18	6.938894-18	8.673617-19	-1.565317-18	1.000000+00	

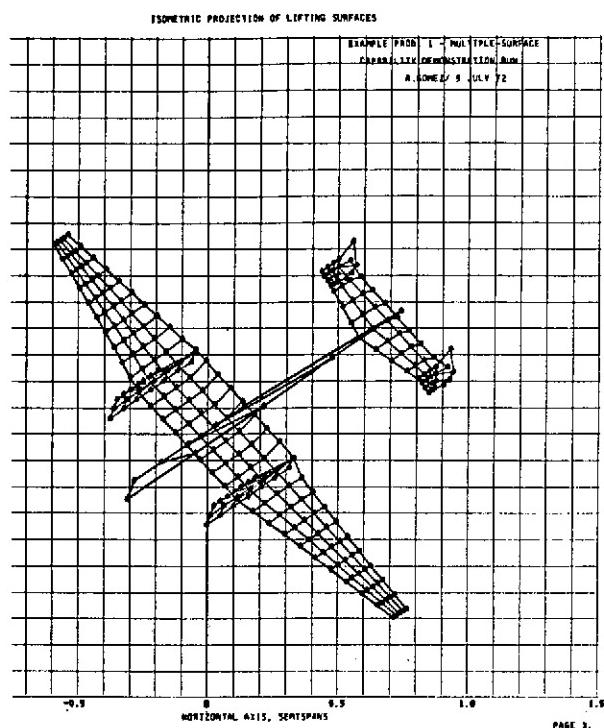
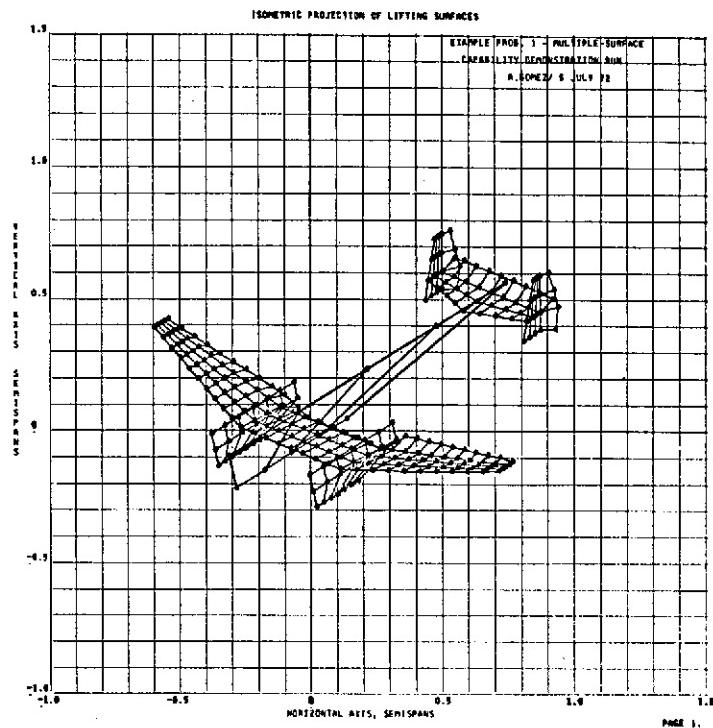
DETERMINANT  
5.870328+04

1.032000+00	7.680000+00	3.030000+00	-2.930000+00	-9.780000-02	TEST MATRIX = [M]
7.865000+00	-6.390000+00	-3.380000+00	5.670000+30	7.103000+00	
3.216000+00	8.900000+00	-1.167000+01	8.323000+00	9.992000+00	
3.031000+00	-1.030000+00	4.180000+00	9.073000+00	9.783000-01	
1.032000+01	5.690000+00	-3.600000+00	3.780000-02	1.514000+01	
3.220950-01	2.931715-01	9.424216-D3	-8.727428-02	+1.363442-01	INVERSE MATRIX = [M]^-1
1.081531-01	1.619780-03	3.541707-02	1.522940-03	-2.353400-02	
-8.700874-02	-1.258476-01	-6.261933-02	1.070551-01	9.243558-02	
-2.495730-02	-1.494837-02	3.317090-02	8.115159-02	-2.028226-02	
-2.808256-01	-2.303324-01	-3.456437-02	8.417013-02	1.896721-01	
1.000000+00	-3.469447-18	4.136809-19	-1.782157-18	3.469447-18	UNIT MATRIX = [M] x [M]^-1
-8.673617-19	1.000000+00	1.734723-18	-1.029992-18	-8.673617-19	
0.000000	8.673617-19	1.000000+00	-2.463172-18	-1.734723-18	
4.336809-19	9.757820-19	0.000000	1.000000+30	1.301043-18	
3.469447-18	6.938894-18	8.573617-19	-1.565317-18	1.000000+00	

5.870329+04 DETERMINANT

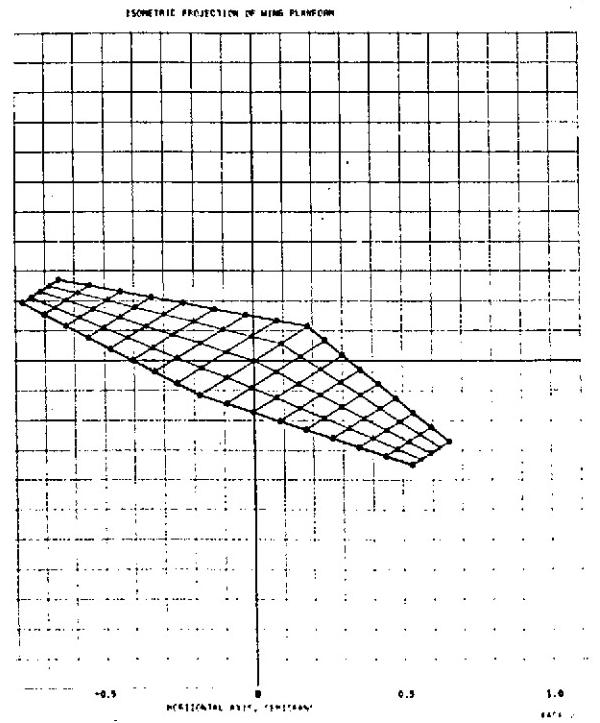
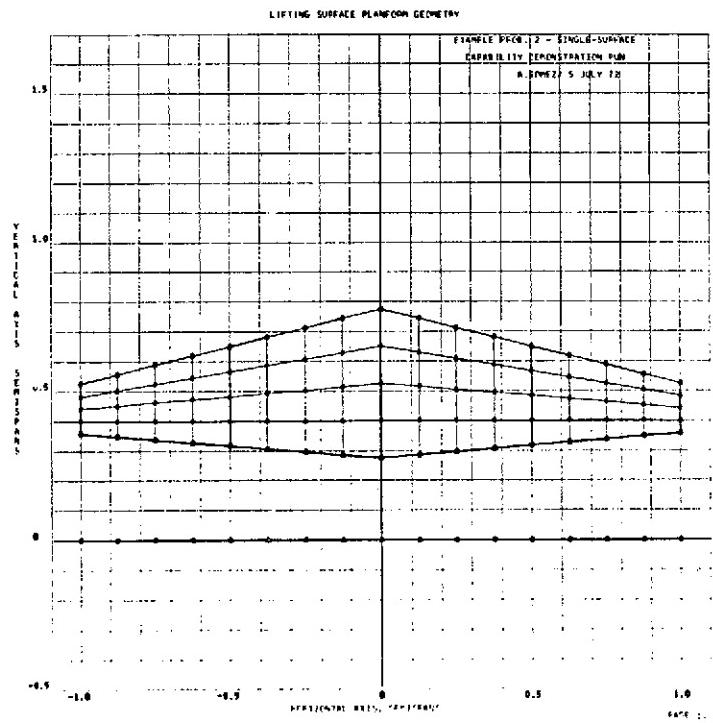
## 6.7 PLOT-OUTPUT

### 1) EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY



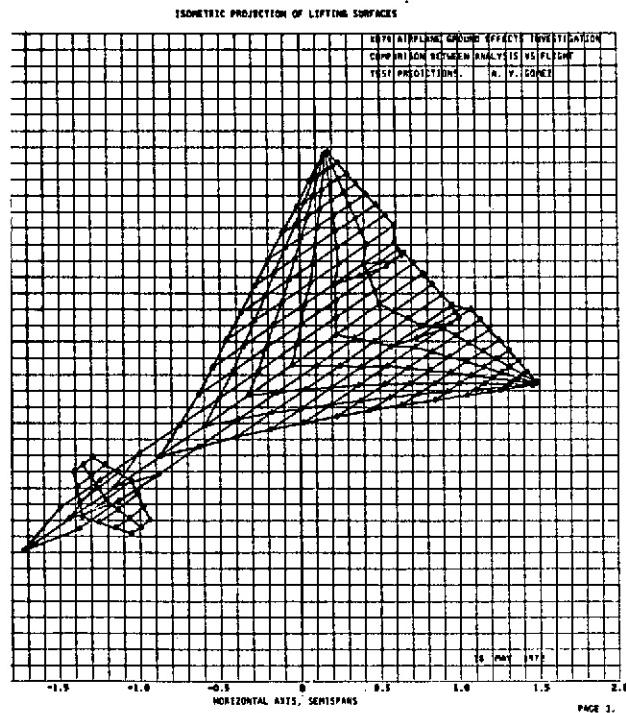
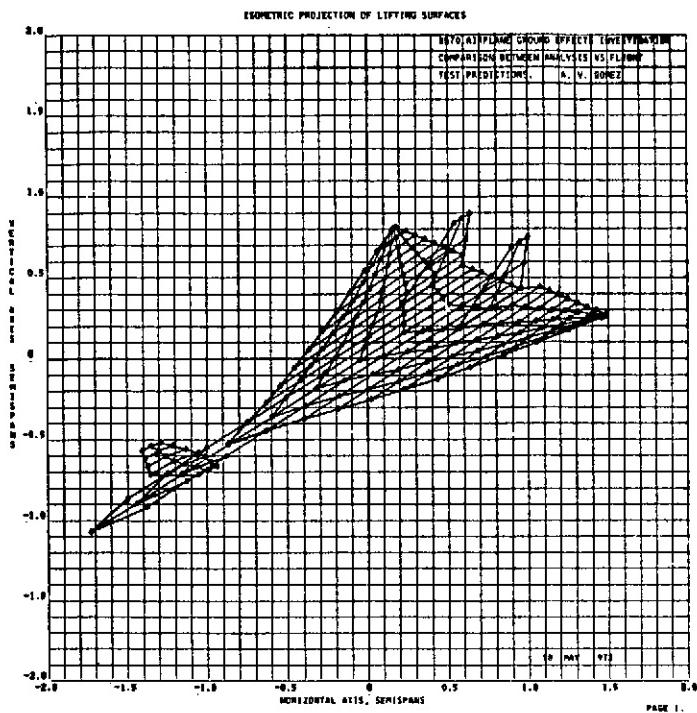
### 2) EXAMPLE PROBLEM # 2, SINGLE-SURFACE ANALYSIS CAPABILITY

NOTE: THE FIRST TWO PLOTS ARE SHOWN BELOW, THE REMAINDER OF THE PLOT-OUTPUT FOR THIS PROBLEM IS PRESENTED IN FIGURE 2.18[C] (PAGES 2-49 THRU. 2-52)

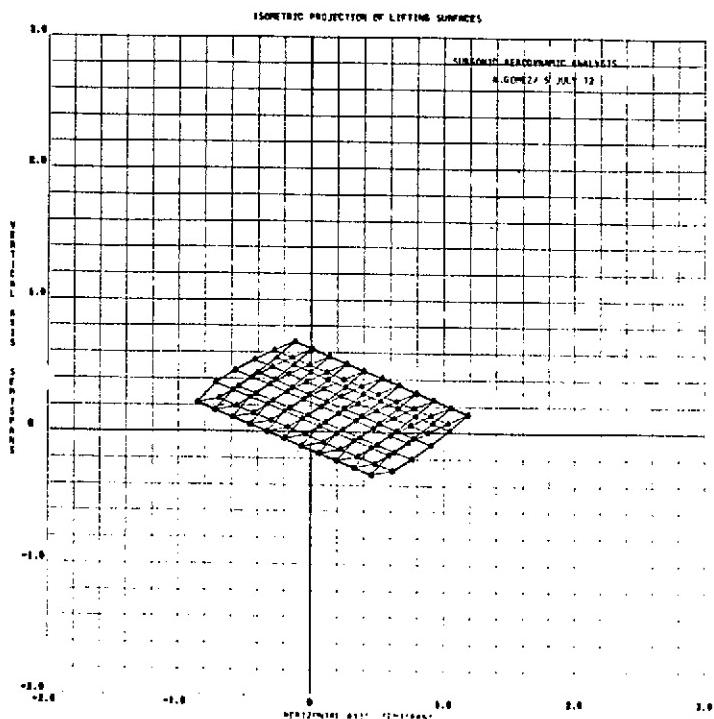


## 6.7 PLOT-OUTPUT (CONTINUED)

### 3) EXAMPLE PROBLEM # 3, NORTH AMERICAN XB-70 AIRPLANE



### 4) EXAMPLE PROBLEM # 4, THICK-WING ANALYSIS



## 7.0 PROGRAM DESCRIPTION

### 7.1 Operating Procedures

The "TRW Vortex-Analysis Program #HA010B (N. SURFACE)" is written in Fortran V source language for execution in the UNIVAC 1108 computer, with a 65K core or a computer of similar configuration. Five separate execution modes for the program are permitted:

#### 1) XQT ISURF or XQT NSURF

Two main execution modes for solving lifting-surface problems by the vortex-lattice method are permitted. NAMELIST statements are used exclusively for input of numeric quantities along with "A" formatted read statements for titles and comments. Card input and tabular printed output are on units 5 and 6 respectively. In addition to the program PCF tape, which is assigned to an unused unit, the following units\* are also used:

Unit 1 (KT1) Input data is stored in unit 1 for all the cases that are to be executed.

Unit 8 (KT2) Output plot-data tape or drum physical unit assignment that is required as an input for the auxiliary execution mode.

Unit 3 (KT3) Work tape or drum physical unit assignment.

#### 2) XQT ISURFT or NSURFT

Two test execution-modes for determining the accuracy of the matrix inversion procedure are permitted. The test execution-modes require no input data. Tabular printed output is on unit 6.

#### 3) XQT TRWPLT

One auxiliary execution mode that is used for obtaining Calcomp or 4060-microfilm output is permitted. This mode of execution requires two modes of input, a tape or drum file (Unit KT2) containing the plot data accompanied by punched-card input describing the manner in which the data is to be plotted. A generalized input processor is used which compares the input symbols to an internal symbol table and stores the data in the appropriate address. The card format, which is input in unit 5, consists of BCD symbol equivalences to the input data in a free-form mode. Printed output is in unit 6 and plot output on magnetic tape (PLT tape assignment).

---

\*Units, 1, 3, and 3 (KT1, KT2, and KT3) may be reassigned in execution (see input instructions).

VØRTEX-LATTICE ANALYSIS PRØGRAM (HA010B)

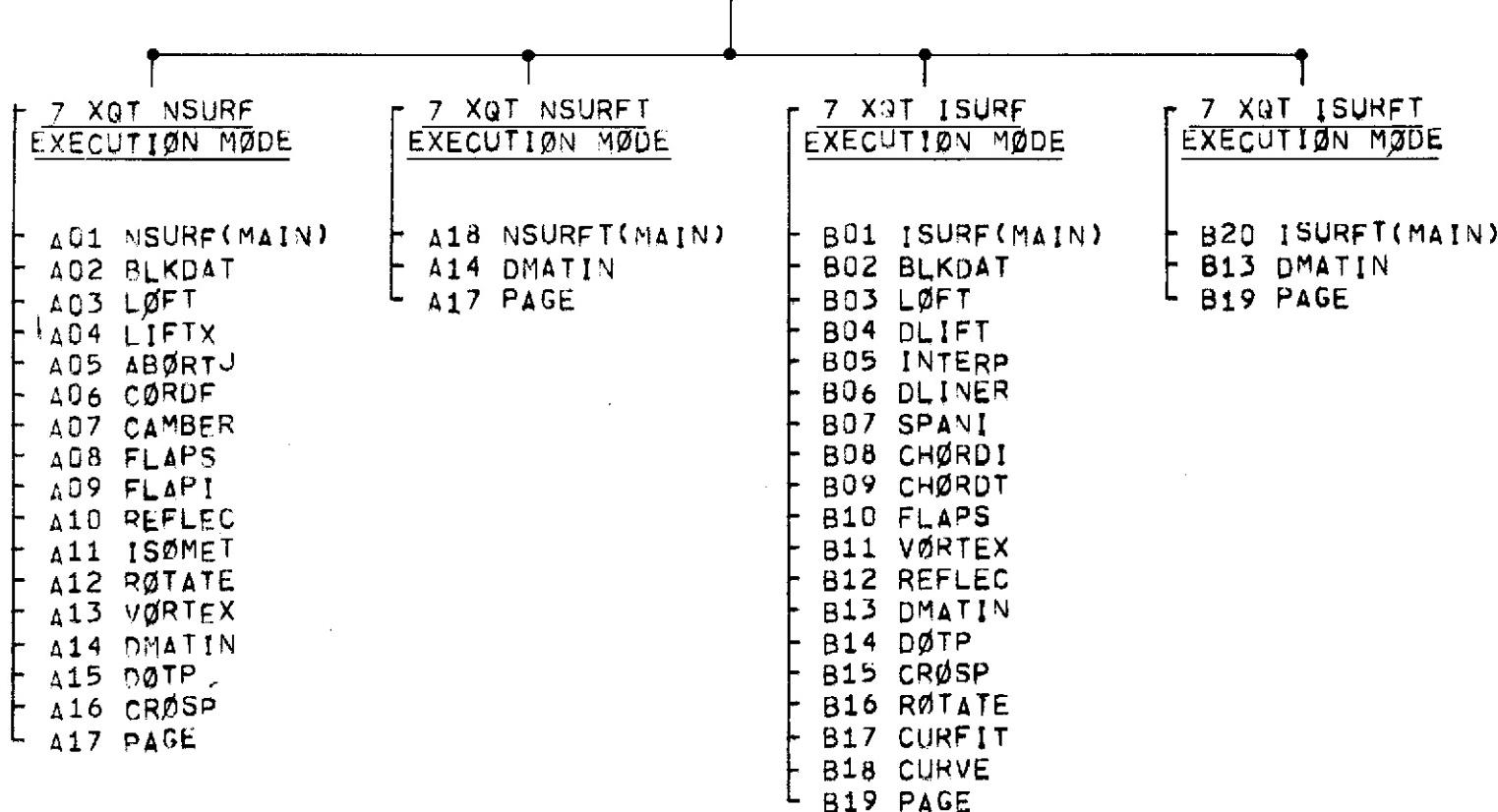


FIGURE 7.01 - TRW VORTEX-LATTICE ANALYSIS PROGRAM OVERLAY STRUCTURE

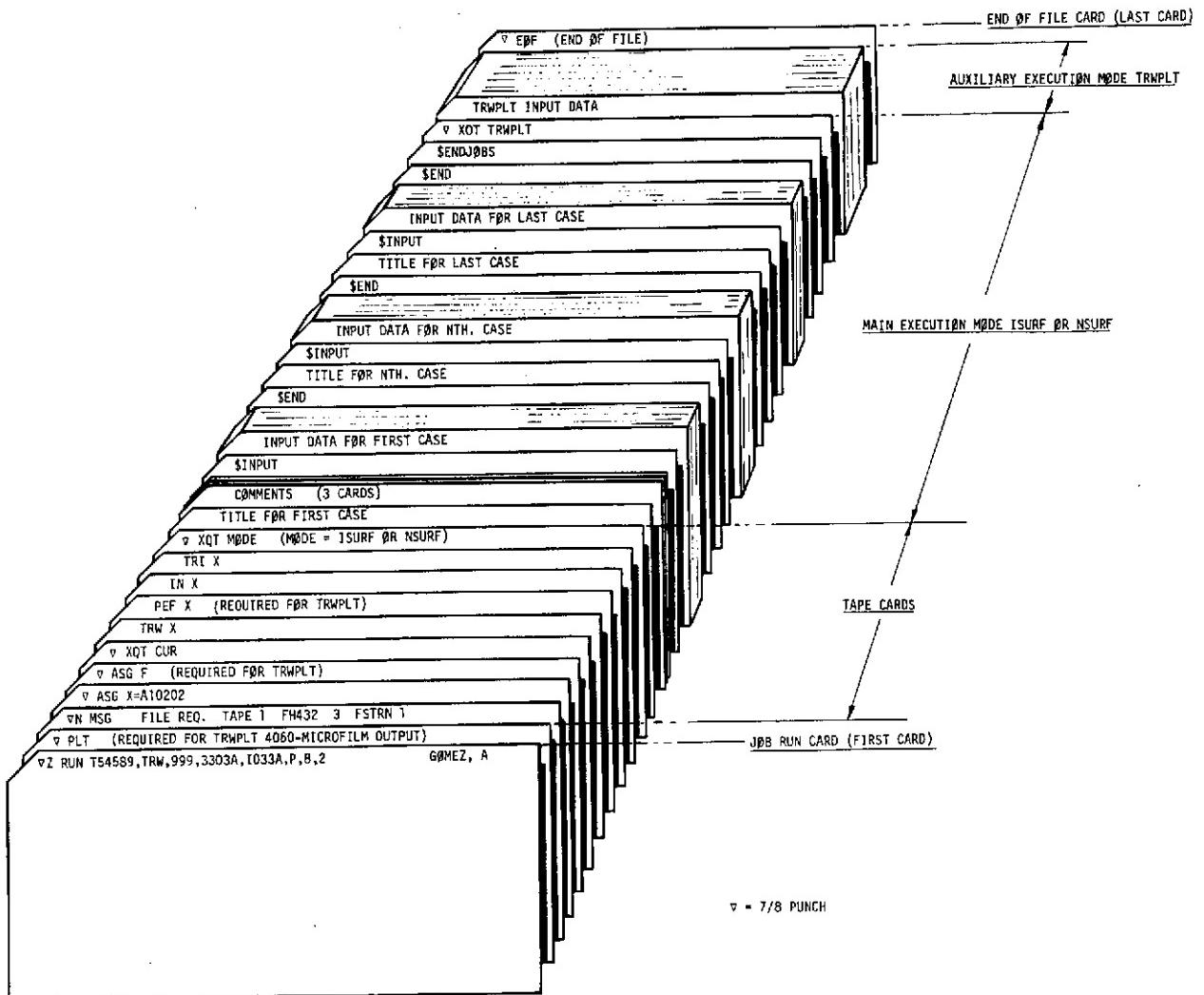


FIGURE 7.02 - CONTROL DECK SETUP

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OF POOR QUALITY

## 7.1 Operating Procedures (Continued)

The program overlay diagram for the main and test execution modes is presented in Figure 7.01 (Page 7-2). The program control deck setup is illustrated in Figure 7.02 (Page 7-3).

## 7.2 Execution Time

For the main execution modes of the program, i.e., XQT ISURF or XQT NSURF, the execution time required to complete a single case is primarily dependent on the total number of vortices or elemental surfaces that are considered simultaneously in arriving at a solution. The other factors that affect the execution time are due to the execution of the special options of the program, such as: ground effects, lifting-line extrapolated solutions, tape output, surface discontinuities (flaps or tabs), and the execution of XQT TRWPLT, the auxiliary mode of execution, for obtaining Calcomp or 4060-microfilm plots. A simple but approximate estimate of the total execution time for completing a given job may be determined using:

$$t_{(\text{seconds})} = \Delta T_1 + N_C \times (N_g \times \Delta T_2(N_M)) + N_P \times \Delta T_3 \quad (7.2.01)$$

$$N_M = N_S \times \sum_{n=1}^{\text{No. Surfaces}} N_{e,n} \quad (7.2.02)$$

where:  $\Delta T_1 = 20$  Time required (seconds) to load the program.

$\Delta T_2 =$  Time required (seconds) to obtain a single vortex-lattice solution (see Figure 7.03).

$\Delta T_3 = 10$  Time required (seconds per plot) for the XQT TRWPLT execution

$N_C =$  Number of cases to complete job.

$N_g \begin{cases} = 1 & \text{No ground effects.} \\ = 2 & \text{With ground effects.} \end{cases}$

$N_P =$  Number of plots.

$N_M =$  Number of elements in the vortex-lattice matrix.

$N_S \begin{cases} = 1 & \text{Unsymmetric loading.} \\ = 0.5 & \text{Symmetric loading} \end{cases}$

$N_{e,n}$  Number of elemental panels for the nth, surface

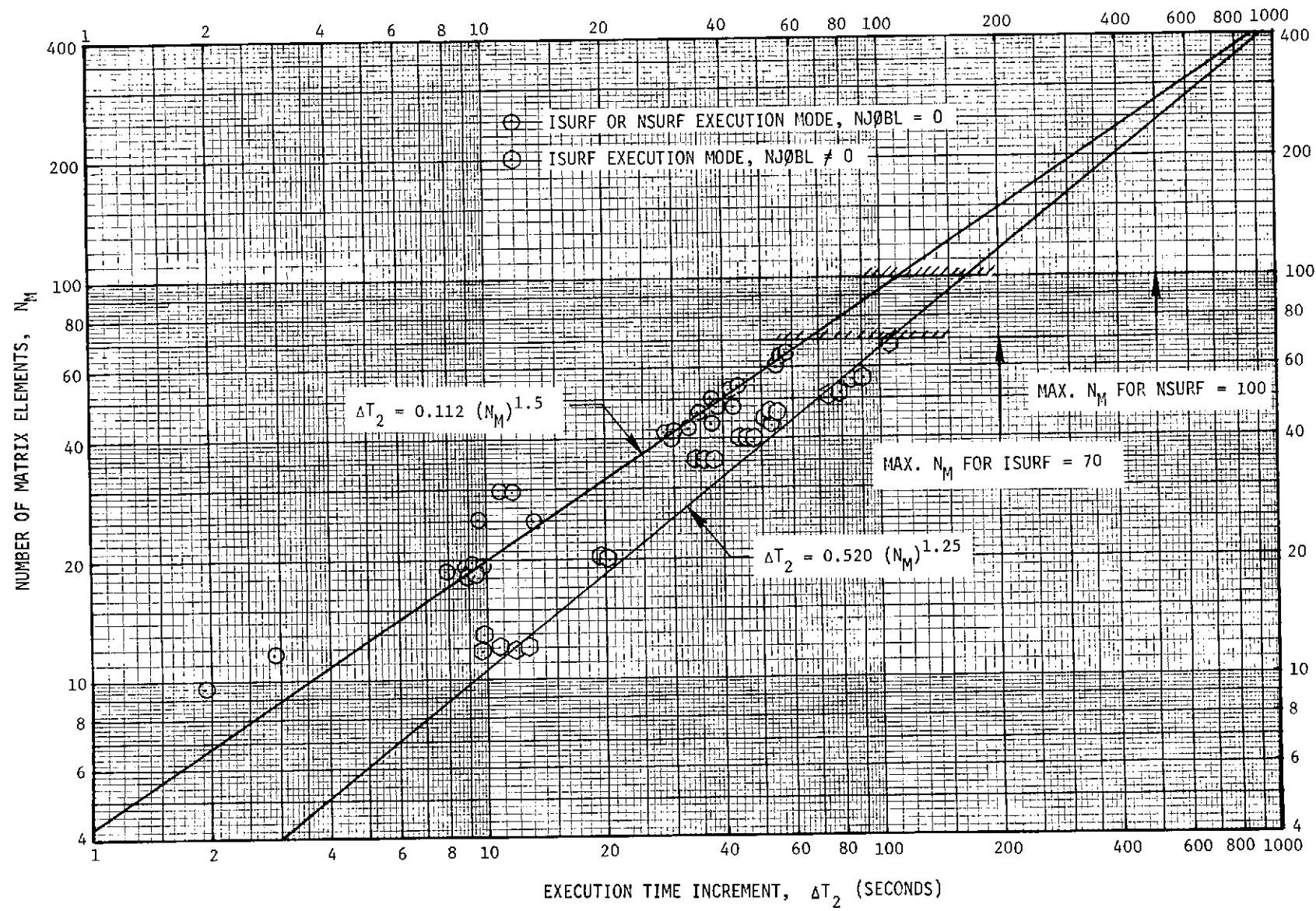


FIGURE 7.03 - EXECUTION TIME INCREMENT  $\Delta T_2$

### 7.3 Program Organization

The present version of the "TRW Vortex-Lattice Analysis Program #HA010B (N.SURFACE)" that is described in this report constitutes an expanded and modified version that was derived from two older prototype programs., i.e., "TRW's Single Surface Vortex-Lattice Analysis Program #HA009A/B (ISURF)," and "TRW's Multiple Surface Vortex-Lattice Analysis Program #HA010A (NSURF)." The prototype programs were developed specifically for analyzing single-surface and multiple-surface configurations respectively. The present version (HA010B) incorporates the same analytical procedures and basically the same source-program code found in the prototype programs and differs only in the input and output format that is used. In addition, the "TRW Generalized Plot Program TRWPLT (Reference 35)" is included in the PCF tape for providing Calcomp and 4060-microfilm plot-output. Five separate modes of execution are permitted (see Section 7.1) that include: (1) two main execution modes for solving lifting-surface problems by the vortex-lattice method, (2) two test execution modes for determining the accuracy of the matrix inversion procedures, and (1) one auxiliary execution mode that is used for obtaining Calcomp or 4060-microfilm output. The source program (absolute and symbolics) in the program PCF tape is arranged in the following form:

<u>1st. File</u>	<u>2nd. File</u>	<u>3rd File</u>
(No Plots)	(With Plots)	(Backup)
NSURF	NSURF	NSURF
ISURF	ISURF	ISURF
NSURFT	NSURFT	NSURFT
ISURFT	ISURFT	ISURFT
-	TRWPLT	TRWPLT

The source program for each of the main execution modes (XQT NSURF or SQT ISURF) is organized in the following manner: one main (driver) routine, one block data (initial values) subroutine, one-vortex-lattice-geometry calculation subroutine, one vortex-lattice-solution calculation subroutine, and a number of special purpose calculation subroutines. The functions performed by each category are as follows:

### 7.3 Program Organization (Continued)

#### Main (Driver) Routine

- 1) Read input data (Unit 5) for all cases to be executed and store the input data in a drum file (Unit 1) for later use and initiate calculations by calling the block data subroutine.
- 2) Read data for the first case (or subsequent cases) from the data drum file (Unit 1).
- 3) Call the vortex-lattice-geometry calculation subroutine for determining all the geometric parameters that will be needed.
- 4) Setup angle of attack loop and multiple-surface loop (if applicable) and proceed to obtain the vortex-lattice-solutions by calling the vortex-lattice-solution calculation subroutine.
- 5) Finalize the first case (or subsequent case) by printing the execution elapsed time and the number of plot files created. Go back to #2 and start the execution of the next case.

#### Block Data (Initial Values) Subroutine

- 1) Stores data for the initial values (built-in Tables, see Section 4).

#### Vortex-Lattice-Geometry Calculation Subroutine

- 1) Calculate the geometry of the vortex-lattice for all the lifting surfaces that are defined in the input.
- 2) Calculate the geometric parameters that define each lifting surface, e.g., the lifting surface reference dimensions.
- 3) Output the calculated geometry for each lifting surface.
- 4) Output on tape (Unit 8) the geometry for each lifting-surface using the special format required for the plotting option (XQT TRWPLT).

### 7.3 Program Organization (Continued)

#### Vortex-Lattice-Solution Calculation Subroutine

- 1) Calculate the influence coefficient matrix.
- 2) Invert the influence coefficient matrix and determine the vorticity or circulation for all the vortex-filaments of the lifting surfaces that are considered simultaneously.
- 3) Calculate the airload distribution on each lifting surface and perform all the required summations.
- 4) Calculate the section-airload coefficients and output same as printed output and on tape (Unit 8) if applicable.
- 5) Finalize the calculations by printing the spatially-integrated airloads for each lifting surface and the net airload summations.

#### Special Purpose Calculation Subroutines

- 1) Perform calculations directed towards a limited objective.

The program logic flow diagrams for the main (driver) routine and the principal subroutines of the program are presented in Figures 7.04 through 7.09 following Section 7.5. A description of the functions performed by each individual routine are presented in Sections 7.4 and 7.5.

### 7.4 Program Routines for XQT NSURF

- 1) MAIN RØUTINE (A01) (237 FORTRAN Statements)

This is the main routine or driver routine for the XQT NSURF execution mode of the program that performs solutions for multiple-lifting-surfaces problems by the vortex-lattice method.

- 2) SUBRØUTINE BLKDAT (A02) (55 FORTRAN Statements)

This is a block data routine where the initial values (built-in tables) of selected input variables are stored (see Section 4.0).

- 3) SUBRØUTINE LØFT (A03) (864 FORTRAN Statements)

Subroutine LØFT constitutes the vortex-lattice geometry calculation routine. In this routine all the geometry calculations are carried out. It includes the setup of the vortex-lattice field point coordinates, unit vectors, areas, etc., and the calculation of the reference dimensions

#### 7.4 Program Routines for XQT NSURF (Continued)

for each lifting surface that is input. Also, as a special option (NFLG(19) ≠ 0), the geometry of the vortex-lattice is output on tape or any specified internal unit which is used as the input data-tape in the execution of XQT TRWPLT for generating Calcomp/4060-microfilm plot-output.

4) SUBROUTINE LIFTX (A04) (1,178 FORTRAN Statements)

This is the vortex-lattice-solution calculation subroutine for multiple-surface analysis (XQT NSURF). In this subroutine all the calculations directed towards obtaining a solution for a given vortex-lattice originate, that include: calculate influence coefficients, calculate the circulation strength of the vortex-filaments, etc. In addition, the section airload coefficients, lift distribution, and spatially-integrated sums of airload force and moments are performed.

5) SUBROUTINE ABORTJ (A05) (92 FORTRAN Statements)

All diagnostic and job termination output originates in this subroutine. Tests are performed in this routine for selected key variables during the execution and if unallowable errors are incurred the job execution is aborted.

6) SUBROUTINE CORDF (A06) (60 FORTRAN Statements)

This routine calculates the planform dimensions at a wing station for a lifting surface, e.g., Y,  $X_{LE}$ ,  $X_{TE}$ , C,  $C_f$ ,  $C_{tab}$ , etc., as a function of a function of a dummy argument W.

7) SUBROUTINE CAMBER (A07) (53 FORTRAN Statements)

Subroutine CAMBER determines the normal coordinate of the median camber line of an airfoil, i.e.,  $Z_a/C$  as a function of  $X_a/C$ .

8) SUBROUTINE FLAPS (A08) (169 FORTRAN Statements)

This routine together with Subroutine FLAPI is used to update the coordinate and unit normal vector (no deflection) of a field point on the surface of a lifting-surface due to flap and/or trim-tab deflection.

9) SUBROUTINE FLAPI (A09) (28 FORTRAN Statements)

See Subroutine FLAPS (#8).

#### 7.4 Program Routines for XQT NSURF (Continued)

10) SUBROUTINE REFLEC (A10) (53 FORTRAN Statements)

Subroutine REFLEC calculates the coordinates of a mirror image of a field point using the ground plane as the mirror plane. It is used in the ground effect analysis for determining the coordinates of the image vortex-lattice.

11) SUBROUTINE ISOMET (A11) (27 FORTRAN Statements)

It transforms the coordinates of a given field point  $P(X,Y,Z)$  to a new coordinate system  $P(X',Y',Z')$  that is used to obtain an isometric projection of the vortex-lattice.

12) SUBROUTINE ROTATE (A12) (45 FORTRAN Statements)

It transforms the coordinates of a given field point  $P(X,Y,Z)$  to a new coordinate system  $P(X',Y',Z')$  involving a prescribed rotation and translation.

13) SUBROUTINE VORTEX (A13) (189 FORTRAN Statements)

Subroutine VORTEX calculates the induced velocity or influence coefficient  $\vec{\psi}$  for a field point  $P(X,Y,Z)$  due to a skew-shaped horseshoe vortex filament of circulation strength  $\Gamma$  defined by the field points  $B(X,Y,Z)$  and  $D(X,Y,Z)$ .

14) SUBROUTINE DMATIN (A14) (149 FORTRAN Statements)

Subroutine DMATIN is a double precision,  $100 \times 100$ , matrix inversion routine.

15) SUBROUTINE DOTP (A15) (17 FORTRAN Statements)

It calculates the dot-product of two vectors.

16) SUBROUTINE CRSP (A16) (20 FORTRAN Statements)

It calculates the vector cross-product of two vectors.

17) SUBROUTINE PAGE (A17) (43 FORTRAN Statements)

This subroutine causes a new page to be started and the job title and job execution flags to be printed at the top of the page in the program execution.

## 7.5 Program Routines for XQT ISURF

18) SUBROUTINE MAIN (B01) (211 FORTRAN Statements)

Same as #1 (A01) except the solution for a single-lifting-surface is considered exclusively.

19) SUBROUTINE BLKDAT (B02) (55 FORTRAN Statements)

Same as #2 (A02) except the solution for a single-lifting-surface is considered exclusively.

20) SUBROUTINE LIFT (B03) 935 FORTRAN Statements)

Same as #3 (A03) except the solution for a single-lifting-surface is considered exclusively.

21) SUBROUTINE DLIFT (B04) (699 FORTRAN Statements)

Same as #4 (A04) except the solution for a single-lifting-surface is considered exclusively.

22) SUBROUTINE INTERP (B05) (406 FORTRAN Statements)

Subroutine INTERP is used to calculate coefficients from two exact vortex-lattice solutions at different angles of attack. These coefficients are used to generate arrays of approximate solutions that are based on the lifting-line theory linearized analysis technique.

23) SUBROUTINE DLINER (B06) (601 FORTRAN Statements)

Subroutine DLINER calculates arrays of approximate solutions using the coefficients determined by INTERP.

24) SUBROUTINE SPANI (B07) (125 FORTRAN Statements)

This routine is used to calculate constant and variable span spacing of the vortex-lattice elemental panels.

25) SUBROUTINE CHORDI (B08) (77 FORTRAN Statements)

Subroutine CHORDI calculates constant or cosine spacing of the vortex-lattice elemental panels in the chordwise direction.

26) SUBROUTINE CHORDT (B09) (44 FORTRAN Statements)

Same as #6 (A06) except the presence of a trim-tab has been omitted.

## 7.5 Program Routines for XQT ISURF (Continued)

27) SUBROUTINE FLAPS (B10) (93 FORTRAN Statements)

Same as #8 (A08) except the presence of a trim-tab has been omitted.

28) SUBROUTINE VØRTEX (B11) (190 FORTRAN Statements)

Equivalent to #13 (A13).

29) SUBROUTINE REFLEC (B12) (50 FORTRAN Statements)

Equivalent to #10 (A10)

30) SUBROUTINE DMATIN (B13) (149 FORTRAN Statements)

This is a double precision, 70 x 70, matrix inversion routine.

31) SUBROUTINE DØTP (B14) (18 FORTRAN Statements)

Equivalent to #15 (A15).

32) SUBROUTINE CRØSP (B15) (21 FORTRAN Statements)

Equivalent to #16 (A16).

33) SUBROUTINE RØTATE (B16) (46 FORTRAN Statements)

Equivalent to #12 (A12).

34) SUBROUTINE CURFIT (B17) (103 FORTRAN Statements)

The CURFIT routine calculates the coefficients of cubics that are used by the CURVE subroutine.

35) SUBROUTINE CURVE (B18) (58 FORTRAN Statements)

Using the coefficients of cubics calculated by the CURFIT subroutine, the subroutine CURVE determines the value and the derivative of a given function at selected values of the independent variable. CURVE together with CURFIT constitute a spline point (cubic), continuous derivative, interpolation procedure used in the program.

36) SUBROUTINE PAGE (B19) (40 FORTRAN Statements)

Same as #17 (A17), except, the title and the job execution flag IFLG used in XQT ISURF are output.

## 7.6 Program Routines for XQT NSURFT and ISURFT

37) MAIN R $\theta$ UTINE (A18) (76 FORTRAN Statements)

This routine performs a matrix-inversion test by calculating the inverse-matrix and the unit-matrix using the values of a 5 x 5 built-in matrix.

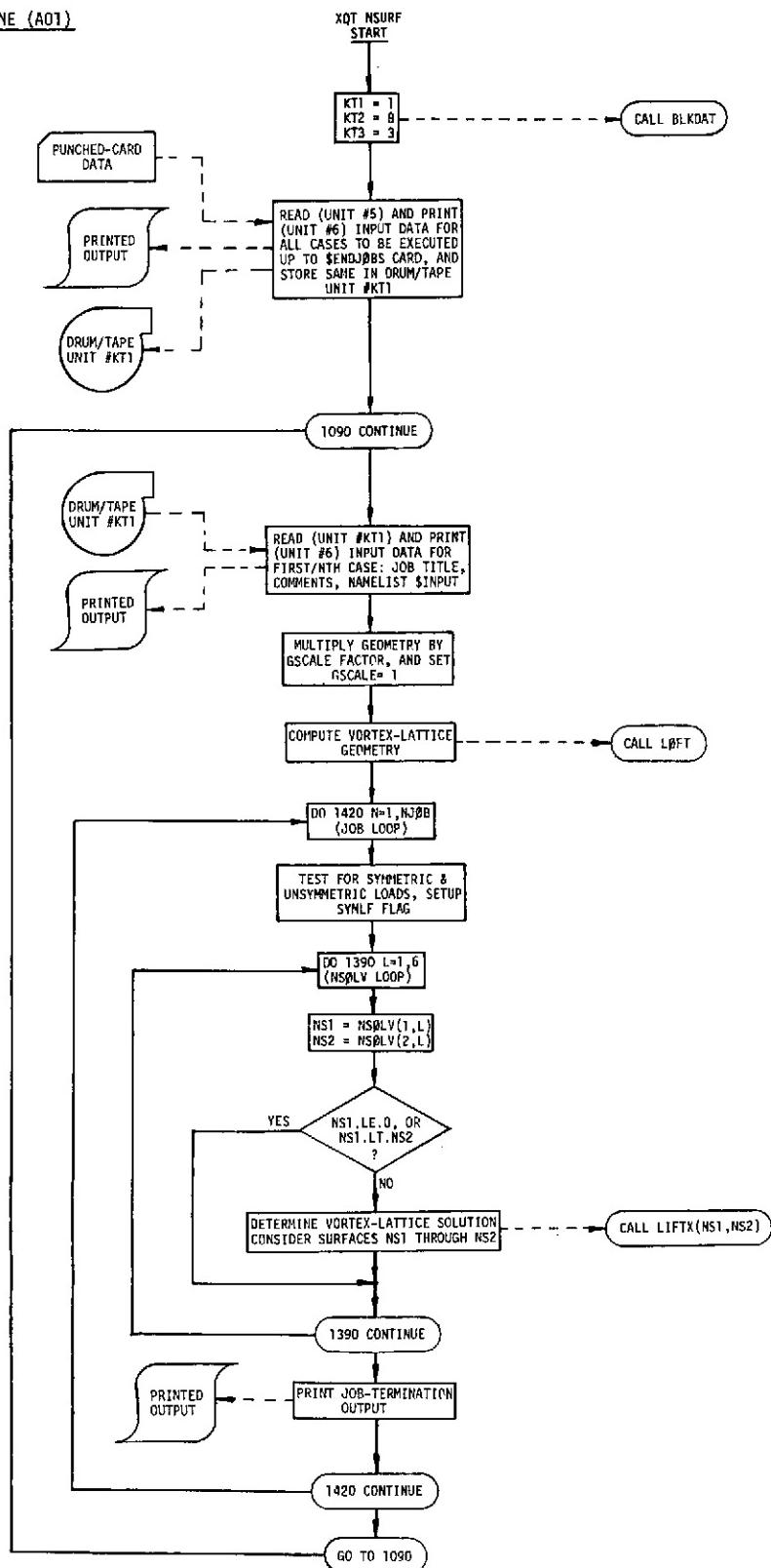
38) MAIN R $\theta$ UTINE (B20) (76 FORTRAN Statements)

Equivalent to #37 (A18).

## 7.7 Program-Logic Flow Diagrams

The program-logic flow diagrams for the main (driver) routines and the most important calculation routines that are used in the main execution modes (XQT NSURF and XQT ISURF) are presented in Figures 7.04 through 7.06 (see Pages 7.14 through 7.19).

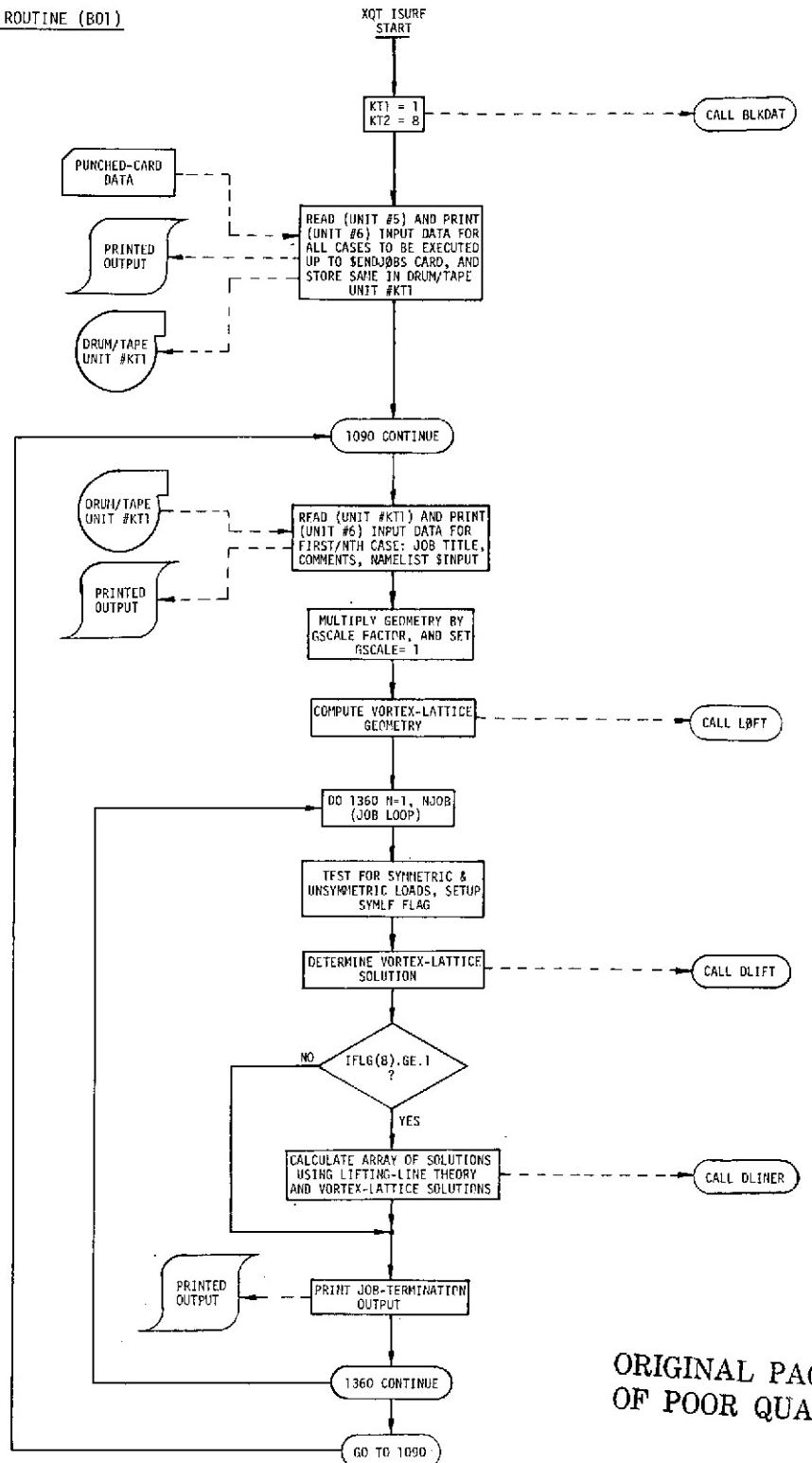
A) HMAIN ROUTINE (A01)



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FIGURE 7.04 - LOGIC-FLOW-DIAGRAMS FOR THE MAIN (DRIVER) EXECUTION ROUTINES  
(PROGRAM HA010B)

B) MAIN ROUTINE (B01)



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FIGURE 7.04 - LOGIC-FLOW-DIAGRAMS FOR THE MAIN (DRIVER) EXECUTION ROUTINES  
(PROGRAM HA07OB) [CONTINUED]

A) SUBROUTINE LOFT (A03)

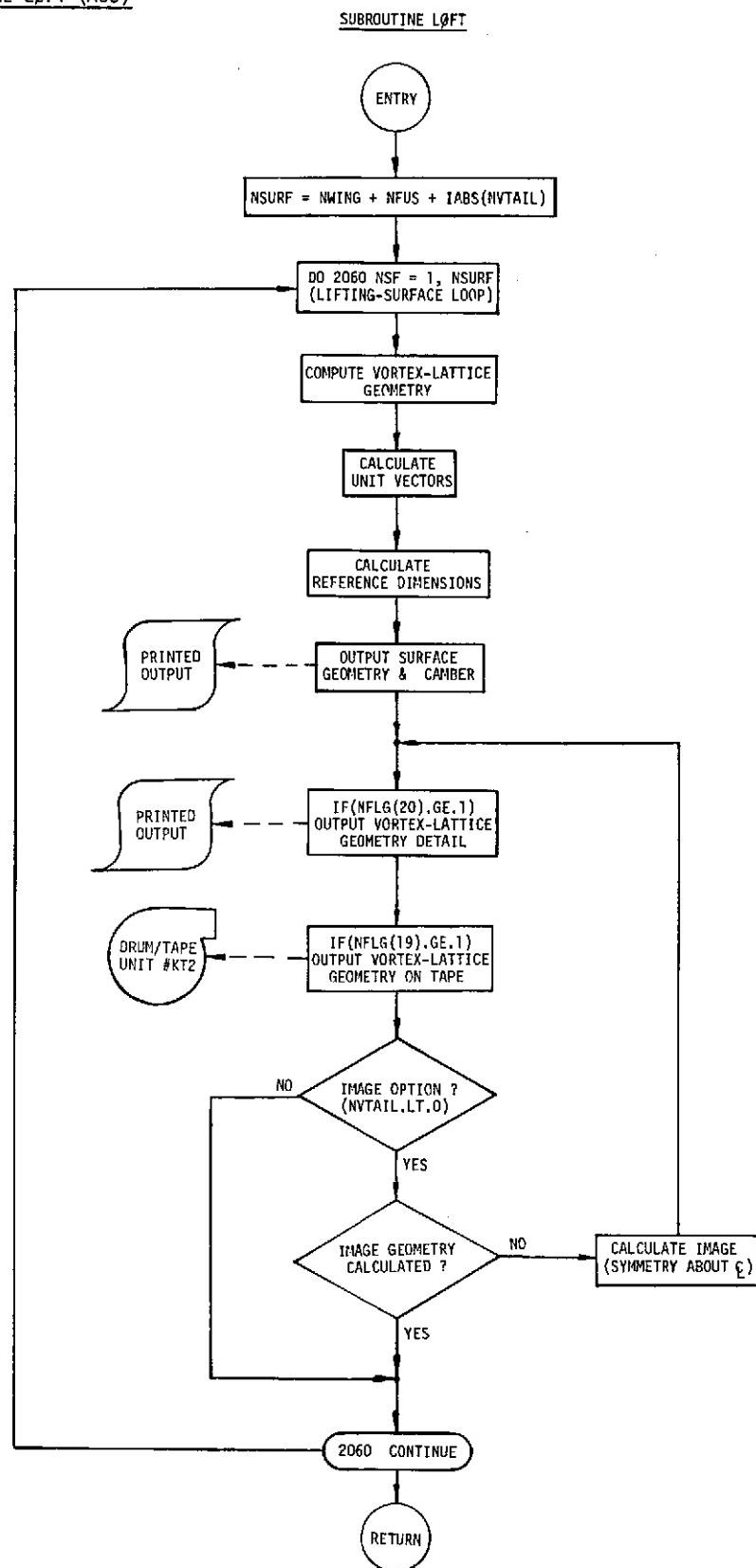


FIGURE 7.05 - LOGIC-FLOW-DIAGRAMS FOR THE VORTEX-LATTICE GEOMETRY CALCULATION ROUTINES (PROGRAM HA010B)

B) SUBROUTINE LOFT (B03)

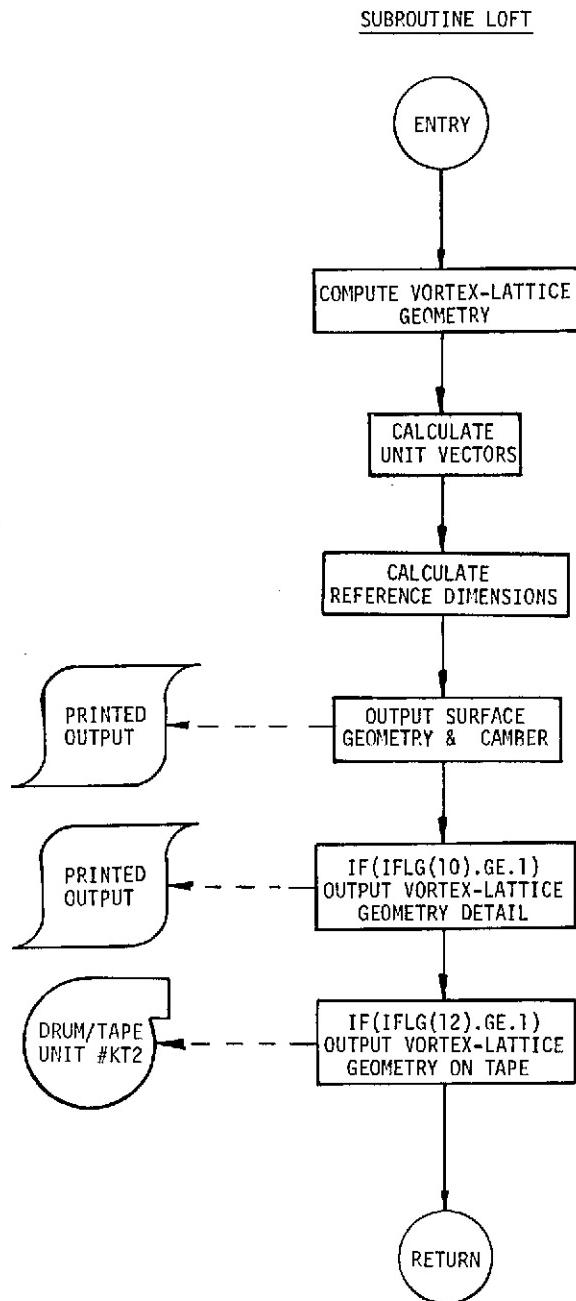
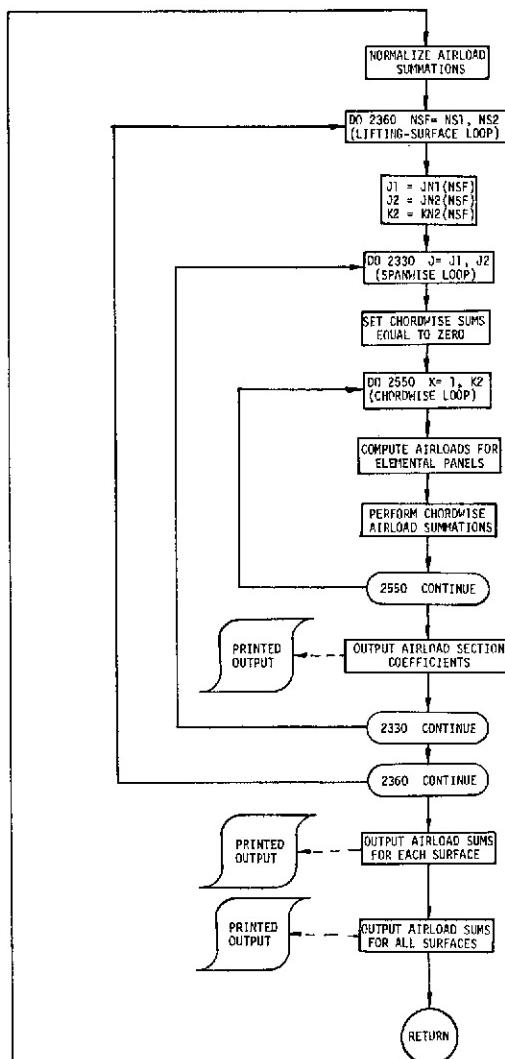
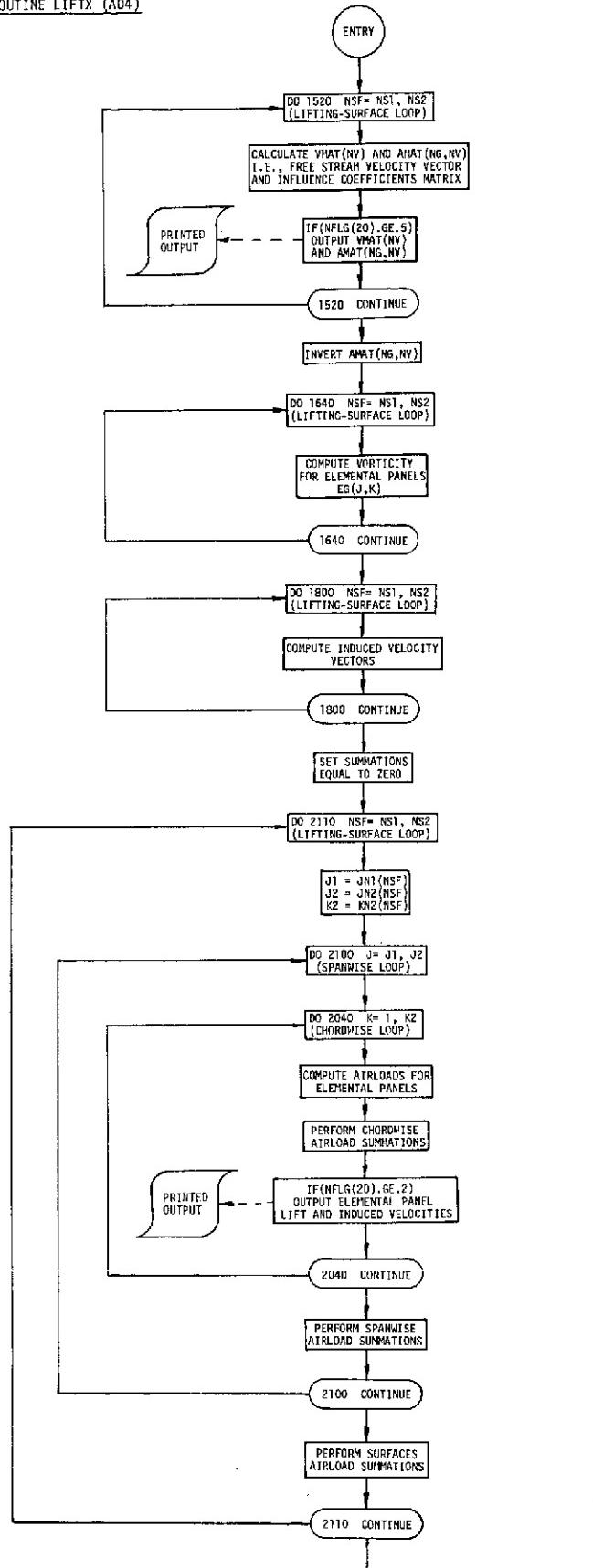


FIGURE 7.05 - LOGIC-FLOW-DIAGRAMS FOR THE VORTEX-LATTICE GEOMETRY CALCULATION ROUTINES (PROGRAM HA010B) [CONTINUED]

a) SUBROUTINE LIFTX (A04)



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FIGURE 7.06 - LOGIC-FLOW-DIAGRAMS FOR THE VORTEX-LATTICE SOLUTION CALCULATION  
ROUTINES (PROGRAM HAD10B)

B) SUBROUTINE DLIFT (R04)

SUBROUTINE DLIFT

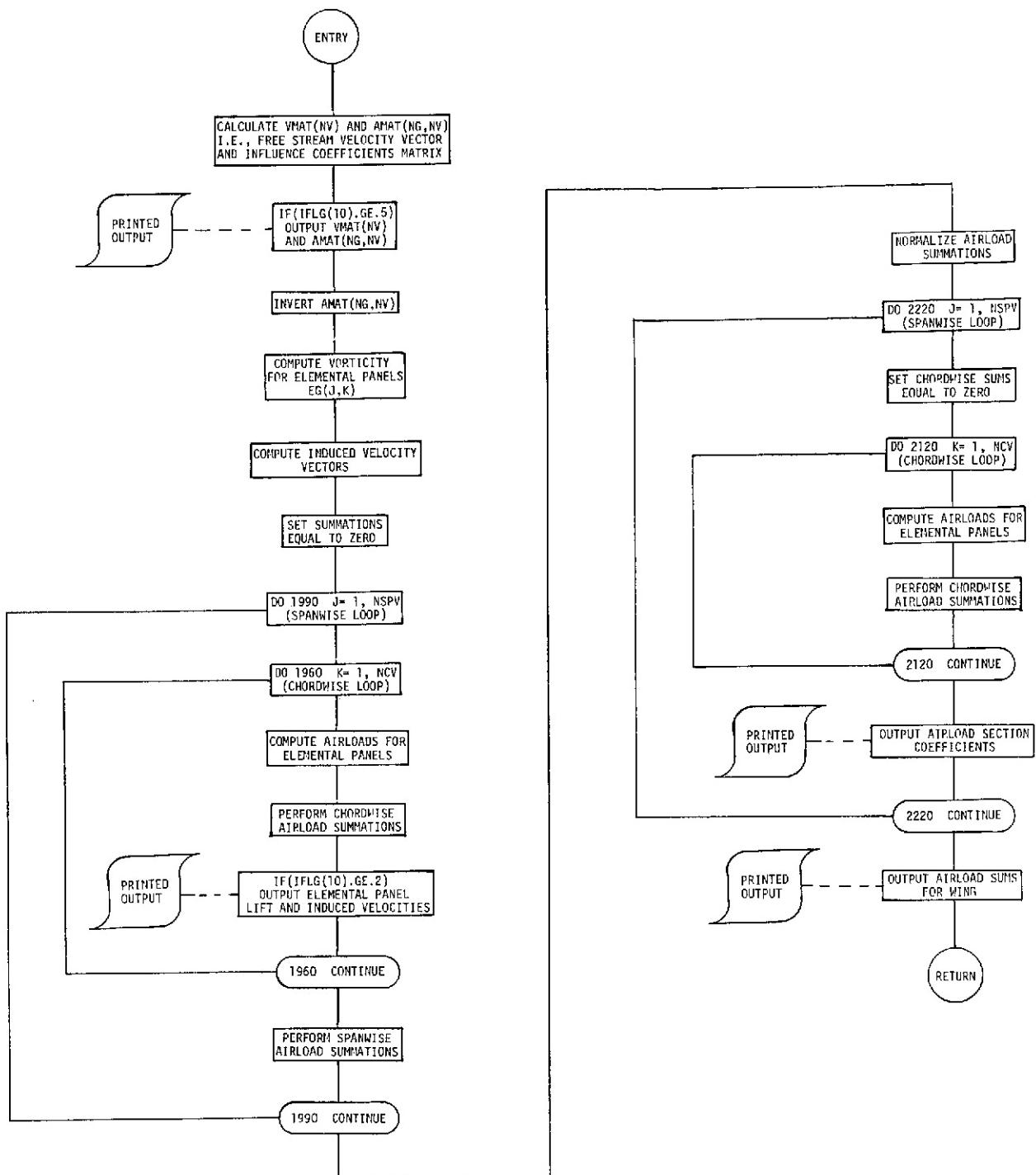


FIGURE 7.06 - LOGIC-FLOW-DIAGRAMS FOR THE VORTEX-LATTICE SOLUTION CALCULATION  
ROUTINES (PROGRAM HA010B) [CONTINUED]

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**9.0 SOURCE-PROGRAM LISTING**

V MAP NSURF,NSURF SEG A01-A02-A03-A04-A05-A06-A07-A08-A09-A10-A11-A12-A13-A14-, A15-A16-A17	NSU 10 NSU 20 NSU 30	1 2 3
V MAP ISURF,ISURF SEG B01-B02-B03-B04-B05-B06-B07-B08-B09-B10-B11-B12-B13-B14-, B15-B16-B17-B18-B19	ISU 10 ISU 20 ISU 30	4 5 6
V MAP NSURFT,NSURFT SEG A18-A14-A17	NSUT 10 NSUT 20	7 8
V MAP ISURFT,ISURFT SEG B20-B13-B19	ISUT 10 ISUT 20	9 10
<pre> V FOR A01,A01 C C * MAIN ROUTINE N-SURFACE VORTEX LATTICE ANALYSIS PROGRAM HA0108-71# A01 10 C A01 20 C A01 30 C A01 40 C A01 50 C A01 60 C A01 70 C A01 80 C A01 90 C A01 100 C A01 110 C A01 120 C A01 130 C A01 140 C A01 150 C A01 160 C A01 170 C A01 180 C A01 190 C A01 200 C A01 210 C A01 220 C A01 230 C A01 240 C A01 250 C A01 260 C A01 270 C A01 280 C A01 290 C A01 300 C A01 310 C A01 320 C A01 330 C A01 340 C A01 350 C A01 360 C A01 370 C A01 380 C A01 390 C A01 400 C A01 410 C A01 420 C A01 430 C A01 440 C A01 450 C A01 460 C A01 470 C A01 480 C A01 490 C A01 500 C A01 510 C A01 520 C A01 530 C A01 540 C A01 550 C A01 560 C A01 570 C A01 580 C A01 590 C A01 600 C A01 610 C A01 620 C A01 630 C A01 640 C A01 650 C A01 660 C A01 670 C A01 680 C A01 690 C A01 700 C A01 710 C A01 720 C A01 730 C A01 740 C A01 750 C A01 760 C A01 770 C A01 780 C A01 790 C A01 800 C A01 810 </pre>		11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91

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      WRITE (KOUT,1050)
      WRITE (KOUT,1040)
      LIN=15
1060 READ (KIN,1000)(STORE(I),I=1,14)
      WRITE (KT1,1000)(STORE(I),I=1,14)
      IF (LINX-LIN) 1070,1080,1080
1070 WRITE (KOUT,1020)
      LIN= 3
1080 LIN= LIN +1
      WRITE (KOUT,1030)(STORE(I),I=1,14)
C
      IF (STORE(11).NE.TEST) GO TO 1060
      END FILE KT1
      REWIND KT1
      WRITE (KOUT,1040)
C
      NCMT=-1
      NCALCP= -1
      ISUM = 0.0
      GSCALE= 1.0
C
      CALL RESET
C
C
1090 READ (KT1,1000)(TITLE(I),I=1,14)
      IF(TITLE(I).EQ.TEST) CALL EXIT
      IF (NCMT) 1100,1100,1110
1100 READ (KT1,1000)(CCMITS(I),I=1,42)
1110 NCMT= 1
      READ (KT1,INPUT)
C
      IF (NCALCP) 1120,1120,1140
1120 NCALCP= 1
1130 REWIND KT2
1140 CONTINUE
C
      NSURF= NWING +NFLS +TARS(NVTAII)
      NSYM = NWING + NFUS
      DO 1160 NSF=1,NSLRF
      SYMLF(NSF) = 0.0
      IF (NSYM-NSF) 1150,1160,1160
1150 SYMLF(NSF) = 1.0
1160 CONTINUE
C
      ALFA0= 0.0
      ZHO = 10000.0
      CMAK = 0.0
C
      XCG = GSCALE*XCG
      YCG = GSCALE*YCG
      ZCG = GSCALE*ZCG
      REFC= GSCALE*REFC
      REFB= GSCALE*REFB
      REFS= GSCALE*GSCALE*REFS
C
      IF (WSMOTH-1.0) 1180,1180,1170
1170 WSMOTH= WSMOTH+GSCALE
1180 CONTINUE
C
      DO 1240 N=1,5
      IF (WFLAPI(N)-1.0) 1200,1200,1190
1190 WFLAPI(N)= WFLAPI(N)*GSCALE
1200 IF (WFLAP2(N)-1.0) 1220,1220,1210
1210 WFLAP2(N)= WFLAP2(N)*GSCALE
1220 IF (WFLAP3(N)-1.0) 1240,1240,1230
1230 WFLAP3(N)= WFLAP3(N)*GSCALE
1240 CONTINUE
C
      JX= NSS(NSURF)
      DO 1270 K=1,10
      DO 1260 J=1,JX
      IF (IFLG(J16)) 1260,1260,1250
1250 ZOC(K,J)= ZOC(K,J)/C(J)
1260 CONTINUE
1270 CONTINUE
C
      DO 1310 J=1,30
      X(J)= X(J)*GSCALE
      Y(J)= Y(J)*GSCALE
      Z(J)= Z(J)*GSCALE
      C(J)= C(J)*GSCALE
      IF (FLAPC(J)-1.0) 1290,1290,1280
1280 FLAPC(J)= FLAPC(J)*GSCALE
1290 IF (TABC(J)-1.0) 1310,1310,1300
1300 TABC(J)= TABC(J)*GSCALE
1310 CONTINUE
C
      GSCALE= 1.0
C
      CALL PAGE
      WRITE (KOUT,INPUT)
C
C
      CALL LOFT
C
      DO 1420 N=1,NJ08
C
      ALFA0= ALFA(N)
      HEIGT= HEIGHT(N)
      ALFA0= ALFA0
      ZHO = HEIGHT
      CMAK = 0.0
      A01 820    92
      A01 830    93
      A01 840    94
      A01 850    95
      A01 860    96
      A01 870    97
      A01 880    98
      A01 890    99
      A01 900   100
      A01 910   101
      A01 920   102
      A01 930   103
      A01 940   104
      A01 950   105
      A01 960   106
      A01 970   107
      A01 980   108
      A01 990   109
      A01 1000  110
      A01 1010  111
      A01 1020  112
      A01 1030  113
      A01 1040  114
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      A01 1060  116
      A01 1070  117
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      A01 1090  119
      A01 1100  120
      A01 1110  121
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      A01 1130  123
      A01 1140  124
      A01 1150  125
      A01 1160  126
      A01 1170  127
      A01 1180  128
      A01 1190  129
      A01 1200  130
      A01 1210  131
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      A01 1280  138
      A01 1290  139
      A01 1300  140
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      A01 1330  143
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      A01 1350  145
      A01 1360  146
      A01 1370  147
      A01 1380  148
      A01 1390  149
      A01 1400  150
      A01 1410  151
      A01 1420  152
      A01 1430  153
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      A01 1460  156
      A01 1470  157
      A01 1480  158
      A01 1490  159
      A01 1500  160
      A01 1510  161
      A01 1520  162
      A01 1530  163
      A01 1540  164
      A01 1550  165
      A01 1560  166
      A01 1570  167
      A01 1580  168
      A01 1590  169
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      A01 1760  186
      A01 1770  187
      A01 1780  188
      A01 1790  189
      A01 1800  190
      A01 1810  191
      A01 1820  192
      A01 1830  193
      A01 1840  194
      A01 1850  195
      A01 1860  196
      A01 1870  197

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      EXECK(1)= 1.0          A01 1880    198
      IF (MACHN(N)-0.95) 1320,1320,1330          A01 1890    199
      1320 CMAK = MACHN(N)          A01 1900    200
      C     CALL ABORTJ(5,CMAK,N)          A01 1910    201
      C     EXECK(1)= SQRT(1.0-CMAK**2)          A01 1920    202
      1330 CONTINUE          A01 1930    203
      C
      C     DO 1390 L=1,6          A01 1940    204
      NS1= NSOLV(1,L)          A01 1950    205
      NS2= NSOLV(2,L)          A01 1960    206
      IF (NS2) 1390+1390,1340          A01 1970    207
      1340 CONTINUE          A01 1980    208
      C
      C     TEST = 0.0          A01 1990    209
      DD 1350 M=NS1,NS2          A01 2000    210
      SYMLF(M)= 0.0          A01 2010    211
      1350 TEST = TEST + ABS(AILDJ(1,M) - AILDJ(2,M)) -0.01          A01 2020    212
      IF (TEST) 1380,1380,1360          A01 2030    213
      1360 CONTINUE          A01 2040    214
      DD 1370 M=NS1,NS2          A01 2050    215
      1370 SYMLF(M)= 1.0          A01 2060    216
      1380 CONTINUE          A01 2070    217
      C
      C     CALL LIFTX(ALFAD,HEIGHT,SYMLF,NS1,NS2)          A01 2080    218
      C
      C     CALL TIMEIMS)          A01 2090    219
      IS= IMS/1000          A01 2100    220
      ISJB= IS-ISUM          A01 2110    221
      ISUM= IS          A01 2120    222
      1390 CONTINUE          A01 2130    223
      C
      C     CALL TIMEIMS)          A01 2140    224
      IS= IMS/1000          A01 2150    225
      ISJB= IS-ISUM          A01 2160    226
      ISUM= IS          A01 2170    227
      1400 CALL PAGE          A01 2180    228
      1410 WRITE (KOUT,1010115JB,IS,KFILE)
      LIN= LIN + LINX          A01 2190    229
      C
      1420 CONTINUE          A01 2200    230
      C
      GO TO 1090          A01 2210    231
      C
      END          A01 2220    232
      A01 2230    233
      A01 2240    234
      A01 2250    235
      C
      LIN= LIN+6          A01 2260    236
      IF (LINX-LIN) 1400,1410,1410          A01 2270    237
      1400 CALL PAGE          A01 2280    238
      1410 WRITE (KOUT,1010115JB,IS,KFILE)
      LIN= LIN + LINX          A01 2290    239
      A01 2300    240
      A01 2310    241
      C
      1420 CONTINUE          A01 2320    242
      C
      GO TO 1090          A01 2330    243
      C
      A01 2340    244
      A01 2350    245
      A01 2360    246
      A01 2370    247

      V FOR A02,A02          A02  10    248
      C
      C     SUBROUTINE BLKDAT          A02  20    249
      C
      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG-72 *A02  60    250
      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *A02  70    251
      C
      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXA02  80    252
      C
      COMMON/DATA00/ TITLE(4), ALFA0, ZHO, CMAK          A02  90    253
      C
      COMMON/DATA01/ KIN, KDUT, KTL, KT2, KT3, KREC, KFILE, LIN, LINK
      1 ,RAD, PIE, CUTOFL, CUTOF2, DELALF, LFLAP, LDRAG, COLDCP
      2 ,IFLG(20), EXECK(15)          A02 100    254
      C
      COMMON/DATA02/ NWING, NFUS, NVTAIL, NSS(5), NSS0(5), NGS(5)
      1 ,X(30), Y(30), Z(30), E(30), C(30), XDCR(30), FLAPC(30), TABC(30) A02 110    255
      2 ,WSMOTH, EWE(30), ELE(30), ETE(30), EHE(30), EHEE(30)
      3 ,XOC(10,5), ZOC(10,30)          A02 120    256
      C
      COMMON/DATA03/ FLAPDJ(5), TABDJ(5), AILDJ(2,5), DELTF1(5), DELTF2(5)
      1 ,WFF1(5), WFF12(5), WFF21(5), WFF22(5), WFF31(5)
      2 ,WFLAP1(5), WFLAP2(5), WFLAP3(5)          A02 130    257
      C
      COMMON/DATA04/ WING(5,16), JN1(5), JN2(5), SYMGF(5), NSURFA02
      1 ,EW(60,10), EY(60,10), EC(60,10), ES(60,10), EG(60,10)          A02 140    258
      2 ,EN(60,10,6), EV(60,10,6), VVINDX(60,10,31)          A02 150    259
      C
      COMMON/DATADS/XCG,YCG,ZCG,REFS,REFC,REFB          A02 160    260
      C
      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXA02 170    261
      C
      DATA KIN/5/, KOUT/6/, KT1/1/, KT2/8/, KT3/3/, KREC/0/, KFILE/0/
      1 ,LIN/0/, LINX/56/, RAD/57.2958/, PIE/3.14159/, CUTOFL/0.0001/
      2 ,CUTOF2/0.0029/, DELALF/1.0/, LFLAP/0/, LDRAG/0/, COLDCP/0.75/
      3 ,IFLG/10,0,0,0, 4,0,0,0,0, 5*0, 0,0,1,0,4/, EXECK/15*0.0/          A02 180    262
      C
      DATA NWING/1/, NFUS/0/, NVTAIL/0/, NSS/2,4*0/, NSS0/1,4*0/, NGS/2,4*0/A02 190    263
      1 ,X/30*0.0/, Y/0.0,1000.0,28*0.0/, Z/30*0.0/, E/30*0.0/, C/100.0,100.0 A02 200    264
      2 ,28*0.0/, XDCR/30*0.25/, FLAPC/30*0.25/, TABC/30*0.125/
      3 ,WSMOTH/0.10/, XOC/0.0,1.0,48*0.0/, ZOC/300*0.0/          A02 210    265
      C
      DATA FLAPDJ/5*0.0/, TABDJ/5*0.0/, AILDJ/10*0.0/
      DATA WFLAP1/5*0.0/, WFLAP2/5*0.60/, WFLAP3/5*1.00/          A02 220    266
      C
      DATA XCG/0.0/, YCG/0.0/, ZCG/0.0/, REFS/1000.0/, REFc/100.0/
      1 ,REFB/100.0/          A02 230    267
      C
      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXA02 240    268
      C
      RETURN          A02 250    269
      C
      XXXXXX          A02 260    270
      C

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C          END                                A02  540      301
C                                              A02  550      302

V FOR A03,A03                                A03  10      303
C          SUBROUTINE LOFT                                A03  20      304
C          * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *A03  50      305
C          * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *A03  60      306
C          XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXA03  80      310
C          XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXA03  90      311
C          DIMENSION COS1(3),COS2(3),COS3(31)           A03 100      312
C          DIMENSION DUMYF(10)                          A03 110      313
C          COMMON/DATA01/ KIN, KOUT, KT1, KT2, KREC, KFILE, LIN, LINK   A03 120      314
C          L ,RAD, PTE, CUTOF1, CUTOF2, DELALF, LFLAP, LORAG, COLOC   A03 130      315
C          2 ,IFLG(201, EXEC(15)
C          COMMON/DATA02/ NWING, NFUS, NVTAIL, NSS(5), NSS0(51), NCS(5)    A03 140      316
C          1 ,X(3D), Y(3D), Z(3D), C(3D), XCRC(30), FLAPC(30), TABC(3D)  A03 150      317
C          2 ,WSMOTH, EWE(30), ELE(30), ETE(30), EHE(30), EHEE(30)        A03 160      318
C          3 ,XOC(10,5), ZOC(10,30)                            A03 170      319
C          COMMON/DATA22/IMAGEF(5),JSINGP(5)                  A03 180      320
C          COMMON/DATA03/FLAPD(5),TABD(5),AILDJ(2,5),DELTFL(5),DELTFL2(5) A03 190      321
C          1 ,WFFL1(5), WFFL2(5), WFFL3(5), WFF21(5), WFF31(5)        A03 200      322
C          2 ,WFLAP1(5), WFLAP2(5), WFLAP3(5)                  A03 210      323
C          COMMON/DATA04/ WINGD(5,16), JN1(51), JN2(51), KN2(5), SYNGF(5), NSURF  A03 220      324
C          1 ,EW(60,10), FY(60,10), EC(60,10), ES(60,10), EG(60,10)     A03 230      325
C          2 ,EN(60,10,6), EV(60,10,6), VVINDX(60,10,3)            A03 240      326
C          COMMON/DATA05/XCG,YCG,ZCG,REFS,REFC,REFB                A03 250      327
C          A03 260      328
C          XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXA03  30      329
C          1000 FORMAT(1X,/,1X)
C          1010 FORMAT(50X,19HLIFTING SURFACE NO.,12,/,50X,21(1H*,/,1X, A03 380      330
C          1 ,60H   SPAN    RONT    TIP    ROOT    TIP    APEA , A03 390      341
C          2 ,59H   ASPECT   MEAN    MGC    YHAR    XBAR   ZBAR, /, A03 400      342
C          361H   CHORD   CHORD   TWIST  TWIST   , A03 410      343
C          4 ,60H   RATIO    CHORD   (MAC)  (MGC)  (MOC)  (MGC), /, A03 420      344
C          5 ,IX,3F10.3,2F10.4,FI0.2,FI0.4,5F10.3,/,1X, A03 430      345
C          6 ,60H   FLAP    FLAP    FLAP    TAB    L.AIL , A03 440      346
C          7 ,60H   R.AIL   DIHED, SWFP  NO.SPAN NO.CHORD NO.CHORD, /, A03 450      347
C          8,61H   SPAN1   SPAN2   SPAN3  DEFLEC  DEFLEC  DEFLEC, A03 460      348
C          9 ,60H   DEFLEC  MGC/4   MGC/4   ELEMENTS ELEMENTS DISCONT., A03 470      349
C          */,1X,9F10.3,17,2I10,/,34X, A03 480      350
C          1 ,56HFUS STA  WING STA  WL STA  AREA   CHORD  SPAN  /, A03 490      351
C          234X,56H X(CG)  Y(CG)  Z(CG)  SICGI  C(CG)  B(CG), /, A03 500      352
C          331X,F10.3,/,1X) A03 510      353
C          A03 520      354
C          1020 FORMAT(1X)
C          1030 FORMAT(1X,
C          1 ,60H   WS      Y      Z      X(LE)  X(C/4)  X(TE)  , A03 550      355
C          2 ,60H   TWIST  DIHE(C/4) SWEP(C/4) C(WING) C(FLAP) C(TAB) , A03 560      356
C          3 ,1X)
C          1040 FORMAT( 1X, 12F10.3 )
C          1050 FORMAT(2IX,50H  XA(1)/C  XA(2)/C  XA(3)/C  XA(4)/C  XA(5)/C, A03 600      362
C          1 ,50H  XA(6)/C  XA(7)/C  XA(8)/C  XA(9)/C  XA(10)/C, /,2IX, A03 610      363
C          2 ,10F10.4,/,1X, 40H   X      Y      ZA(1)/C  ZA(2)/C, A03 620      364
C          3 ,60H  ZA(3)/C  ZA(4)/C  ZA(5)/C  ZA(6)/C  ZA(7)/C  ZA(8)/C, A03 630      365
C          4 ,20H  ZA(9)/C  ZA(10)/C ,/,1X ) A03 640      366
C          1060 FORMAT( 1X,12F10.4 ) A03 650      367
C          A03 660      368
C          1070 FORMAT(3X,4H) K, 40H   Y      Z      WL    EW , A03 680      369
C          1,30H   DWL   DC    DS  ,/,1X)
C          1080 FORMAT(1X,2I3,12(IPE10.3) ) A03 700      372
C          A03 710      373
C          1090 FORMAT(3X,IHJ,2X,1HK,5X,2HXV,8X,2HYV,8X,2HZV,8X,3H1XV,7X,3H1YY,7X A03 720      374
C          + 3H1ZV,7X,2HXX,8X,2HYN,8X,2H2N,8X,3H1XN,7X,3H1YN,7X,3H1ZN,/,1X) A03 730      375
C          1100 FORMAT( 1X, 2I3, 12(IPE10.3) ) A03 740      376
C          A03 750      377
C          1110 FORMAT(5X,1HB,9X,2HCP,8X,2HCCT,BX,ZHER,BX,2HET,8X,1HS,9X,2HAR,BX, A03 760      378
C          + 2HMC,BX,3HMG,C,6X,4HYMG,C,BX,4HXMGC,6X,4HZMGC,/,1X) A03 770      379
C          1120 FORMAT(1X,12F10.3 )
C          A03 780      380
C          1130 FORMAT(1X,/,1X,14H(EDF PLOT FILE,13,1H) )
C          A03 800      382
C          A03 810      383
C          XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXA03  820      384
C          A03 830      385
C          A03 840      386
C          A03 850      387
C          *** INITIALIZE ***
C          XERDX = 0.0 A03 860      388
C          ZEROX = 0.0 A03 870      389
C          NWING= NWING + NFUS A03 880      390
C          NSURF= NWING + IABS(NVTAIL) A03 890      391
C          MFLAG= 100 A03 900      392
C          IFINVTAIL.LT.01 MFLAG= NWING +1 A03 910      393
C          NFUS = 0 A03 920      394
C          CALL ABORTJ(1,XERDX,NSURF) A03 930      395
C          SUMW = 0.0 A03 940      396
C          NX= 30 A03 950      397
C          DO 1190 N=1,NX A03 960      398
C                               A03 970      399
C                               A03 980      400
C                               A03 990      401
C                               A03 1000     402
C                               A03 1010     403

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EWE(N)= SUMW
ELE(N)= X(N) - C(N)*XDCR(N)
ETE(N)= ELE(N) + C(N)
CFLAP = FLAPC(N)
CTAB = TABC(N)
C
IF (CFLAP-1.0) 1140,1150,1150
1140 CFLAP = CFLAP*C(N)
1150 IF (CTAB-1.0) 1140,1170,1170
1160 CTAB = CTAB*C(N)
1170 CONTINUE
EHE(N)= ETE(N) - CFLAP
EHEE(N)= ETE(N) - CTAB
IF (N-NX1 1180,1190,1190
1180 N1= N+1
1190 SUMW = SUMW + SQRT( (Z(N)-Z(N1))**2 + (Y(N)-Y(N1))**2 )
C
NO = 1
J1= 0
DO 1200 N=1,NSURF
J2= NSS(N)
CALL ABORTJ(10,J2,J1)
J1= J2
NSS0(N)= NO
1200 NO = NSS(N) + 1
J1 = 1
C
CALL ABORTJ(6,XEROX,N)
C
C *** N-SURFACE LOOP ***
C
DO 2060 NSF=1,NSURF
C
C ** CALCULATE WETTED LENGTH **
C
NREPET= 0
IF(NSF,GE,MFLAG) NREPET= 1
NSFM1= NSF - 1
NSF5 = NSF + 5
NSF10= NSF + 10
NSPV = IFLG(NSF)
NCV = IFLG(NSF5)
NCDIS= IFLG(NSF10)
NCVW = NCV - NCDIS
NSPV1= NSPV + 1
NCV1 = NCV + 1
NB = NSS(NSF)
NO = NSS0(NSF)
NK = NC5(NSF)
OCORD = 1.0/FLOAT(NCVW)
IMAGEF(NSF)= NSPV
JSINGP(NSF)= 0
C
CALL ABORTJ(3,XEROX,NCV)
CALL ABORTJ(7,XERDX,NK)
CALL ABORTJ(8,XERDX,NSPV)
CALL ABORTJ(9,XERDX,NCVW)
C
BOTU =(EWE(NB)-EWE(NO))
C
DELTf1(NSF) = WSMOTH
DELTf2(NSF) = WSMOTH
C
IF (DELTf1(NSF)-1.0) 1210,1220,1220
1210 DELTf1(NSF) = DELTf1(NSF)*BOTU
DELTf2(NSF) = DELTf2(NSF)*BOTU
1220 CONTINUE
C
WFF11(NSF) = WFLAPI(NSF)
WFF21(NSF) = WFLAP2(NSF)
WFF31(NSF) = WFLAP3(NSF)
C
IF (WFF11(NSF)-1.0) 1230,1240,1240
1230 WFF11(NSF) = WFF11(NSF)*BOTU
1240 IF (WFF21(NSF)-1.0) 1250,1260,1260
1250 WFF21(NSF) = WFF21(NSF)*BOTU
1260 IF (WFF31(NSF)-1.0) 1270,1280,1280
1270 WFF31(NSF) = WFF31(NSF)*BOTU
1280 CONTINUE
C
WFF11(NSF) = WFF11(NSF) - DELTf1(NSF)/2.0
WFF21(NSF) = WFF21(NSF) - DELTf1(NSF)/2.0
WFF31(NSF) = WFF31(NSF) - DELTf1(NSF)/2.0
C
WFF12(NSF) = WFF11(NSF) + DELTf1(NSF)
WFF22(NSF) = WFF21(NSF) + DELTf1(NSF)
C
C ** CALCULATE WING PANELS **
C
IF (NSF-NWING) 1290,1290,1300
1290 CONTINUE
SYMF= 2.0
SPAN = BOTU*2.0
WINGD(NSF,1)= Y(NB)*2.0
GO TO 1310
1300 CONTINUE
SYMF= 1.0
SPAN= BOTU
WINGD(NSF,1)= SPAN
1310 CONTINUE
C
WINGD(NSF,2)= C(NO)
WINGD(NSF,3)= C(NB)

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      WINGD(NSF,4)= E( NO)
      WINGD(NSF,5)= E( NB)

C      DSPAN= SPAN/FLOAT(NSPV)
C
C      JN1(NSF) = J1
C      JN2(NSF) = J1 + NSPV -1
C      KN2(NSF) = NCV
C      J2 = JN2(NSF)
C      J3 = J2 +1
C
C      CALL ABORTJ(Z,XEROX,J3)
C
C      SYMGF(NSF)= SYMF
C
C
C      ** VRTEX LATTICE GEOMETRY **
C
C      DO 1390 J=J1,J3
C
C      WS= -BOTU*(SYMF-1.0) + DSPAN*FLCAT(J-J1)
C      WAA= ABS(WS)
C      WA = WAA + EWE(NC)
C
C      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2) A03 2080 510
C
C      SIGN=1.0
C      TEST= 0.0001-WAA
C      IF (TEST) 1320,1330,1330
C      1320 SIGN= WS/WAA
C      1330 YB= YA*SIGN
C      IF (INCDIS=1) 1350,1340,1340
C      1340 CW= CW - CF
C      1350 CONTINUE
C
C      DO 1360 K=1,NCV
C
C      XKM= FLOAT(K-1)
C
C      EY(J,K)= WS
C      EC(J,K)= CW*DCORD
C      EW(J,K)= WA
C
C      EV(J,K,1)= XLE + CW*DCORD*(10.25+XKM)
C      EV(J,K,2)= YB
C      EV(J,K,3)= ZLE
C
C      EN(J,K,1)= XLE + CW*DCORD*(COLOCP + XKM)
C      EN(J,K,2)= YB
C      EN(J,K,3)= ZLE
C
C      1360 CONTINUE
C
C      IF (INCDIS=1) 1390,1370,1380
C      1370 CONTINUE
C
C      K= NCV
C      EC(J,K)= CF
C      EV(J,K,1)= XTE - CF*0.75
C      EN(J,K,1)= XTE - CF*(1.0 - COLOCPI)
C      GO TO 1390
C
C      1380 CONTINUE
C      K= NCV
C      EC(J,K)= CTAB
C      EV(J,K,1)= XTE - CTAB*0.75
C      EN(J,K,1)= XTE - CTAB*(1.0 - COLOCPI)
C      K= K -1
C      EC(J,K)= CF - CTAB
C      EV(J,K,1)= XTE - CTAB - EC(J,K)*0.75
C      EN(J,K,1)= XTE - CTAB - EC(J,K)*(1.0 - COLOCPI)
C
C      1390 CONTINUE
C
C      DO 1410 J=J1,J3
C
C      WA= EW(J,1)
C
C      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2) A03 2090 511
C
C      DO 1400 K=1,NCV
C
C      XF1= EV(J,K,1)
C      ZF1= EV(J,K,3)
C
C      CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XF1,ZF1)
C
C      EV(J,K,3)= ZF1
C
C      XF1= EN(J,K,1)
C      ZF1= EN(J,K,3)
C
C      CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XF1,ZF1)
C
C      EN(J,K,3)= ZF1
C
C      1400 CONTINUE
C      1410 CONTINUE
C
C      DO 1430 J=J1,J2

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      J3= J+1
C      DO 1420 K=1,NCV
C      EYIJ,K1)= FYIJ3,K)-EYIJ,K)
C      ESIJ,K)= 0.5*EYIJ,K)* ( ECIJ,K) +ECIJ3,K)
C      ENIJ,K,1)= 0.5*( ENIJ,K,1) + ENIJ3,K,1)
ENIJ,K,2)= 0.5*( ENIJ,K,2) + ENIJ3,K,2)
ENIJ,K,3)= 0.5*( ENIJ,K,3) + ENIJ3,K,3)
C      1420 CONTINUE
C      1430 CONTINUE
C
C      ** CALCULATE UNIT VECTORS **
C
      DO 1490 J=J1,J2
      J3= J+1
C      DO 1480 K=1,NCV
C
      SUM1= 0.0
      SUM2= 0.0
      DO 1440 L=1,3
      M= L +3
      EVIL,K,M)= EVIJ3,K,L) - EVIJ,K,L)
      ENIJ,K,M)= FN(J,K,L) - 0.5*( EVIJ3,K,L)+EVIJ,K,L)
      SUM1= SUM1 + EVIJ,K,M)**2
      1440 SUM2= SUM2 + ENIJ,K,M)**2
C
      SUM1 = SQRT(SUM1)
      SUM2 = SQRT(SUM2)
C
      DO 1450 L=1,3
      M= L +3
      EVIJ,K,M)= EVIJ,K,M)/SUM1
      ENIJ,K,L)= XTE - CTAB - ECIJ,K)*(1.0 - COLOCPI)
C
C      1390 CONTINUE
C
      DO 1410 J=J1,J3
      WA= EW(J,1)
C      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
      A03 3610
      A03 3620
      A03 3630
      A03 3640
      A03 3650
      A03 3660
      A03 3670
      A03 3680
      A03 3690
      A03 3700
      A03 3710
      A03 3720
      A03 3730
      A03 3740
      A03 3750
      A03 3760
      A03 3770
      A03 3780
      A03 3790
      A03 3800
      A03 3810
      A03 3820
      A03 3830
      A03 3840
      A03 3850
      A03 3860
      A03 3870
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      720
      721
      DO 1450 L=1,3

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M= L +3
EV(J,K,M)= EV(J,K,M)/SUM1
COS1(L)= -EN(J,K,M)/SUM2
1450 COS2(L)= -EV(J,K,M)
C CALL CROSP(COS1,CCS2,COS3)
C SUM2= 0.0
DO 1460 L=1,3
1460 SUM2= SUM2 + COS3(L)**2
C SUM2= SQRT(SUM2)
C DO 1470 L=1,3
M= L+3
1470 EN(J,K,M)= COS3(L)/SUM2
C 1480 CONTINUE
1490 CONTINUE
C ** CALCULATE WING CONSTANTS **
C WINGDINSURF, 1) = B, SPAN
C WINGDINSURF, 2) = CR, ROOT CHORD
C WINGDINSURF, 3) = CT, TIP CHORD
C WINGDINSURF, 4) = ER, GEOMETRIC TWIST AT ROOT STATION
C WINGDINSURF, 5) = FT, GEOMETRIC TWIST AT TIP STATION
C WINGDINSURF, 6) = S, AREA
C WINGDINSURF, 7) = AR, ASPECT RATIO
C WINGDINSURF, 8) = CM, MEAN CHORD
C WINGDINSURF, 9) = MGC, MEAN GEOMETRIC CHORD
C WINGDINSURF,10) = YMGC, SPAN LOCATION OF 1/4 MGC
C WINGDINSURF,11) = XMGC, HORIZONTAL MOMENT ARM TO 1/4 MGC
C WINGDINSURF,12) = ZMGC, VERTICAL MOMENT ARM TO 1/4 MGC
C WINGDINSURF,13) = DIHEDRAL ANGLE OF 1/4 MGC
C WINGDINSURF,14) = SWEEP ANGLE OF 1/4 MGC
C
C JX = 100
DJX = FLOAT(JX)
DSPAN= SPAN/DJX
ZERO = DSPAN/2.0
C
SUMA = 0.0
SUMY = 0.0
SUMC = 0.0
SUMX = 0.0
SUMY = 0.0
SUMZ = 0.0
C
DO 1530 J=1,JX
C
WS= -ROTU=(SYMF-1.0) + DSPAN=FLOAT(J-1) + ZERO
WA= ABS(WS) + EWF(NO)
C
CALL CORDF(WA,YA,XLE,XTF,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
A03 4760 778
C
DA= CW*DSPAN
IF(SYMF-1.0)1520,1520,1500
1500 DA= DA/SQRT( 1.0 + TAND**2 )
1520 CONTINUE
C
DAC = DA*CW
XF1 = XLE + CW/4.0
ZF1 = ZLE
C
CALL CAMPER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XF1,ZF1)
A03 4870 789
C
SUMA = SUMA + DA
SUMC = SUMC + DAC
SUMX = SUMX + DA*XF1
SUMY = SUMY + DA*YA
SUMZ = SUMZ + DA*ZF1
C
1530 CONTINUE
C
C
WINGDINSF, 6) = SUMA
WINGDINSF, 7) = (WINGDINSF,1)**2)/WINGDINSF,6)
WINGDINSF, 8) = WINGDINSF,6)/WINGDINSF,1)
WINGDINSF, 9) = SUMC/SUMA
WINGDINSF,10) = SUMY/SUMA
WINGDINSF,11) = SUMX/SUMA
WINGDINSF,12) = SUMZ/SUMA
C
WA= 0.5*( EWF(NO) + EWF(NB) )
C
CALL CORDF(WA,YA,XLE,XTF,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
A03 5080 810
C
WINGDINSF,13) = RAD*ATAN1 TAND )
WINGDINSF,14) = RAD*ATAN1 TANS )
C
C
** WING GEOMETRY **
C
CALL PAGE
WRITE (KOUT,1010)NSF,(WINGDINSF,II,I=L,12),WFLAP1(NSF),WFLAP2(NSF)A03 5180
1,WFLAP3(NSF),FLAPD1(NSF1),TABDJ1(NSF1),(AI1DJ1,NSF1,I=1,2),(WINGDINSF,A03 5190
2F,II,I=13,14),NSPV,NCV,NCDIS,XCG,YCG,ZCG,REF5,REFC,REFB A03 5200 822
A03 5210 823
C
LIN= LIN + 19
WRITE (KOUT,1030)
LIN= LIN+3
C
A03 4200 722
A03 4210 723
A03 4220 724
A03 4230 725
A03 4240 726
A03 4250 727
A03 4260 728
A03 4270 729
A03 4280 730
A03 4290 731
A03 4300 732
A03 4310 733
A03 4320 734
A03 4330 735
A03 4340 736
A03 4350 737
A03 4360 738
A03 4370 739
A03 4380 740
A03 4390 741
A03 4400 742
A03 4410 743
A03 4420 744
A03 4430 745
A03 4440 746
A03 4450 747
A03 4460 748
A03 4470 749
A03 4480 750
A03 4490 751
A03 4500 752
A03 4510 753
A03 4520 754
A03 4530 755
A03 4540 756
A03 4550 757
A03 4560 758
A03 4570 759
A03 4580 760
A03 4590 761
A03 4600 762
A03 4610 763
A03 4620 764
A03 4630 765
A03 4640 766
A03 4650 767
A03 4660 768
A03 4670 769
A03 4680 770
A03 4690 771
A03 4700 772
A03 4710 773
A03 4720 774
A03 4730 775
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A03 4750 777
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A03 4780 780
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A03 4800 782
A03 4810 783
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A03 4880 790
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A03 4900 792
A03 4910 793
A03 4920 794
A03 4930 795
A03 4940 796
A03 4950 797
A03 4960 798
A03 4970 799
A03 4980 800
A03 4990 801
A03 5000 802
A03 5010 803
A03 5020 804
A03 5030 805
A03 5040 806
A03 5050 807
A03 5060 808
A03 5070 809
A03 5080 810
A03 5100 812
A03 5110 813
A03 5120 814
A03 5130 815
A03 5140 816
A03 5150 817
A03 5160 818
A03 5170 819
A03 5180 820
A03 5190 821
A03 5200 822
A03 5210 823
A03 5220 824
A03 5230 825
A03 5240 826
A03 5250 827

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C      DSPAN= SPAN/20.0          A03 5260    826
C      DO 1580 J=1,21           A03 5270    829
C
C      WS= -BOTUN(SYMF-1.0) + DSPAN*FLDAT(J-1)   A03 5280    830
C      WAA = ABS(WS)           A03 5290    831
C      WA = WAA + EWE(NO)     A03 5300    832
C
C      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2) A03 5310    833
C
C      SIGN = 1.0              A03 5320    834
C      TEST= 0.0001 - WAA      A03 5330    835
C      IF (TEST) 1540,1550,1550   A03 5340    836
C
C      1540 SIGN= WS/WAA       A03 5350    837
C      1550 YB= YA*SIGN        A03 5360    838
C      DTHE = SIGN*RAD*ATAN(TAND)   A03 5370    839
C      BETA = SIGN*RAD*ATAN(TANS)   A03 5380    840
C      XCO4= XLE + CW/4.0        A03 5390    841
C
C      IF (LINX-LIN) 1560,1570,1570   A03 5400    842
C      1560 CALL PAGE          A03 5410    843
C      WRITE (KOUT,1030)         A03 5420    844
C      LIN = LIN +2            A03 5430    845
C      1570 WRITE (KOUT,1040)WS,YB,ZLE,XLE,XCO4,XTE,EPS,DIHE,BETA,CW,CF,CTAB A03 5440    846
C      LIN= LIN +1            A03 5450    847
C      1580 CONTINUE          A03 5460    848
C
C
C      ** AIRFOIL SECTION **   A03 5470    849
C
C      WRITE (KOUT,1000)         A03 5480    850
C      LIN= LIN +3            A03 5490    851
C      IF (LINX-LIN) 1590,1600,1600   A03 5500    852
C      1590 CALL PAGE          A03 5510    853
C      LIN= LIN +7            A03 5520    854
C      1600 WRITE (KOUT,1050)(XOC(I,NSF),I=1,10)   A03 5530    855
C      LIN= LIN +1            A03 5540    856
C
C      DO 1610 J=N0,NB          A03 5550    857
C      IF (LINX-LIN) 1610,1620,1620   A03 5560    858
C      1610 CALL PAGE          A03 5570    859
C      WRITE (KOUT,1050)(XOC(I,NSF),I=1,10)   A03 5580    860
C      LIN= LIN +7            A03 5590    861
C      1620 CONTINUE          A03 5600    862
C
C      DO 1630 K=1,10          A03 5610    863
C      1630 DUMYFK=0.0          A03 5620    864
C      K=0
C      DO 1640 KN=1,NK          A03 5630    865
C      K= K+1
C      1640 DUMYF(K)= ZOC(KN,J)
C      WRITE (KOUT,1060)X(J),Y(J),(DUMYF(I),I=1,10)   A03 5640    866
C      LIN= LIN +1            A03 5650    867
C      1650 CONTINUE          A03 5660    868
C
C      LIN= LIN +3            A03 5670    869
C      IF (LINX-LIN) 1660,1670,1670   A03 5680    870
C      1660 CALL PAGE          A03 5690    871
C      LIN= LIN+3             A03 5700    872
C      1670 WRITE (KOUT,1000)         A03 5710    873
C
C
C      *** DEBUG OUTPUT ***   A03 5720    874
C
C      J16 = JN1(NSF)          A03 5730    875
C      J26 = JN2(NSF)          A03 5740    876
C      1680 J1 = JN1(NSF)        A03 5750    877
C      J2 = JN2(NSF)          A03 5760    878
C      K2 = KN2(NSF)          A03 5770    879
C      IF (IFLG(201-1) 1880,1690,1690   A03 5780    880
C      1690 CONTINUE          A03 5790    881
C
C      J3 = J2 +1             A03 5800    882
C
C      LIN= LIN +2            A03 5810    883
C      IF (LINX-LIN) 1700,1710,1710   A03 5820    884
C      1700 CALL PAGE          A03 5830    885
C      LIN= LIN+3             A03 5840    886
C      1710 WRITE (KOUT,1070)         A03 5850    887
C
C      DO 1770 K=1,K2          A03 5860    888
C      LIN= LIN +1            A03 5870    889
C      1720 CALL PAGE          A03 5880    890
C      LIN= LIN +2            A03 5890    891
C
C      DO 1770 K=1,K2          A03 5900    892
C      LIN= LIN +1            A03 5910    893
C
C      J1 = JN1(NSF)          A03 5920    894
C      J2 = JN2(NSF)          A03 5930    895
C      K1 = KN1(NSF)          A03 5940    896
C      K2 = KN2(NSF)          A03 5950    897
C      IF (JSINGP(NSF).EQ.J1) GO TO 1760   A03 5960    898
C
C      LIN= LIN +1            A03 5970    899
C      IF (LINX-LIN) 1720,1730,1730   A03 5980    900
C      1730 JPI= J +1          A03 5990    901
C
C      WA= EWE(NO)           A03 6000    902
C      TEST= ABS(EW(J,K1)-EW(JPI,K1)) -0.001   A03 6010    903
C
C      1740 WA= 0.5*(EW(J,K1)+EW(JPI,K1))   A03 6020    904
C      1750 WB= WA - EWE(NO)        A03 6030    905
C
C      WRITE (KOUT,1080)J,K,(EN(J,K,I),I=2,31,WB,WA,EY(J,K),EC(J,K),ES(J,A03 6040    906
C      *K1)                   A03 6050    907
C
C      1760 CONTINUE          A03 6060    908
C      1770 WRITE (KOUT,1020)         A03 6070    909
C
C      LIN= LIN + 3            A03 6080    910
C      IF (LINX-LIN) 1780,1790,1790   A03 6090    911
C
C      1780 CALL PAGE          A03 6100    912
C
C      DO 1770 K=1,K2          A03 6110    913
C      LIN= LIN +1            A03 6120    914
C
C      DO 1770 K=1,K2          A03 6130    915
C      LIN= LIN +1            A03 6140    916
C
C      DO 1770 K=1,K2          A03 6150    917
C      LIN= LIN +1            A03 6160    918
C
C      DO 1770 K=1,K2          A03 6170    919
C
C      JPI= J +1              A03 6180    920
C
C      WA= EWE(NO)           A03 6190    921
C      TEST= ABS(EW(J,K1)-EW(JPI,K1)) -0.001   A03 6200    922
C
C      1740 WA= 0.5*(EW(J,K1)+EW(JPI,K1))   A03 6210    923
C
C      1750 WB= WA - EWE(NO)        A03 6220    924
C
C      WRITE (KOUT,1080)J,K,(EN(J,K,I),I=2,31,WB,WA,EY(J,K),EC(J,K),ES(J,A03 6230    925
C      *K1)                   A03 6240    926
C
C      1760 CONTINUE          A03 6250    927
C      1770 WRITE (KOUT,1020)         A03 6260    928
C
C      LIN= LIN + 3            A03 6270    929
C      IF (LINX-LIN) 1780,1790,1790   A03 6280    930
C
C      1780 CALL PAGE          A03 6290    931
C
C      DO 1770 K=1,K2          A03 6300    932
C
C      LIN= LIN +1            A03 6310    933

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      LIN= LIN + 3
1790 WRITE (KOUT,1000)
      LIN= LIN +2
      IF (LINX-LIN) 1800,1810,1810
1800 CALL PAGE
      LIN= LIN +2
1810 WRITE (KOUT,1090)
C
      DO 1850 K=1,K2
      LIN= LIN +1
      DO 1840 J=J1,J2
      IF (JSINGP(NSF).EQ.J) GO TO 1840
      LIN= LIN +1
      IF (LINX-LIN) 1820,1830,1830
1820 CALL PAGE
      WRITE (KOUT,1090)
      LIN= LIN +2
1830 CONTINUE
      WRITE (KOUT,11001J,K,{EV(J,K,I),I=1,6},{EN(J,K,I),I=1,6})
1840 CONTINUE
1850 WRITE (KOUT,1020)
C
C
      LIN= LIN +3
      IF (LINX-LIN) 1860,1870,1870
1860 CALL PAGE
      LIN= LIN +3
1870 WRITE (KOUT,1000)
C
C
C * WRITE ON CALCOMPLOT TAPE *
C
1880 IF (IFLG(19)-1) 2020,1890,1890
1890 CONTINUE
C
      KFILE = KFILE +1
      KREC = 1
      KWORD = 6
C
      J1 = J16
      J2 = J26
      J3 = J26 +1
      REFL = WINGD(1,1)/2.0
      XZER = WINGD(1,11)
      YZER = 0.0
      ZZER = WINGD(1,12)
C
C * RECORD 1 - FILE NSURF *
C
      DO 1900 J=J1,J3
C
      WA = EW(J,1)
C
      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
      A03 6640 966
      A03 6650 967
      A03 6660 968
      A03 6670 969
      A03 6680 970
      A03 6690 971
      A03 6700 972
      A03 6710 973
      A03 6720 974
      A03 6730 975
      A03 6740 976
      A03 6750 977
      A03 6760 978
      A03 6770 979
      A03 6780 980
      A03 6790 981
      A03 6800 982
      A03 6810 983
      A03 6820 984
      A03 6830 985
      A03 6840 986
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      A03 6860 988
      A03 6870 989
      A03 6880 990
      A03 6890 991
      A03 6900 992
      A03 6910 993
      A03 6920 994
      A03 6930 995
      A03 6940 996
      A03 6950 997
      A03 6960 998
      A03 6970 999
      A03 6980 1000
      A03 6990 1001
      A03 7000 1002
      A03 7010 1003
      A03 7020 1004
      A03 7030 1005
      A03 7040 1006
      A03 7050 1007
      A03 7060 1008
      A03 7070 1009
      A03 7080 1010
      A03 7090 1011
      A03 7100 1012
      A03 7110 1013
      A03 7120 1014
      A03 7130 1015
      A03 7140 1016
      A03 7150 1017
      A03 7160 1018
      A03 7170 1019
      A03 7180 1020
      A03 7190 1021
      A03 7200 1022
      A03 7210 1023
      A03 7220 1024
      A03 7230 1025
      A03 7240 1026
      A03 7250 1027
      A03 7260 1028
      A03 7270 1029
      A03 7280 1030
      A03 7290 1031
      A03 7300 1032
      A03 7310 1033
      A03 7320 1034
      A03 7330 1035
      A03 7340 1036
      A03 7350 1037
      A03 7360 1038
      A03 7370 1039
C
      * RECORD 2 - FILE NSURF *
C
      KREC= KREC +1
      KWORD= 3
      ITET= 1
C
      DO 1960 J=J1,J3
C
      WA = EW(J,1)
C
      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
      A03 7400 1040
      A03 7410 1041
      A03 7420 1042
      A03 7430 1043
      A03 7440 1044
      A03 7450 1045
      A03 7460 1046
      A03 7470 1047
      A03 7480 1048
      A03 7490 1049
      A03 7500 1050
      A03 7510 1051
      A03 7520 1052
      A03 7530 1053
      A03 7540 1054
      A03 7550 1055
      A03 7560 1056
      A03 7570 1057
      A03 7580 1058
      A03 7590 1059
      A03 7600 1060
      A03 7610 1061
      A03 7620 1062
      A03 7630 1063
      A03 7640 1064
      A03 7650 1065
      A03 7660 1066
      A03 7670 1067
      A03 7680 1068
      A03 7690 1069
      A03 7700 1070
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      A03 7720 1072
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      A03 7790 1079
      A03 7800 1080
      A03 7810 1081
      A03 7820 1082
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      A03 7930 1093
      A03 7940 1094
      A03 7950 1095
      A03 7960 1096
      A03 7970 1097
      A03 7980 1098
      A03 7990 1099
      A03 8000 1100
      A03 8010 1101
      A03 8020 1102
      A03 8030 1103
      A03 8040 1104
      A03 8050 1105
      A03 8060 1106
      A03 8070 1107
      A03 8080 1108
      A03 8090 1109
      A03 8100 1110
      A03 8110 1111
      A03 8120 1112
      A03 8130 1113
      A03 8140 1114
      A03 8150 1115
      A03 8160 1116
      A03 8170 1117
      A03 8180 1118
      A03 8190 1119
      A03 8200 1120
      A03 8210 1121
      A03 8220 1122
      A03 8230 1123
      A03 8240 1124
      A03 8250 1125
      A03 8260 1126
      A03 8270 1127
      A03 8280 1128
      A03 8290 1129
      A03 8300 1130
      A03 8310 1131
      A03 8320 1132
      A03 8330 1133
      A03 8340 1134
      A03 8350 1135
      A03 8360 1136
      A03 8370 1137
      A03 8380 1138
      A03 8390 1139
      A03 8400 1140
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      A03 8480 1148
      A03 8490 1149
      A03 8500 1150
      A03 8510 1151
      A03 8520 1152
      A03 8530 1153
      A03 8540 1154
      A03 8550 1155
      A03 8560 1156
      A03 8570 1157
      A03 8580 1158
      A03 8590 1159
      A03 8600 1160
      A03 8610 1161
      A03 8620 1162
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      A03 8660 1166
      A03 8670 1167
      A03 8680 1168
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      A03 8800 1180
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      A03 13530 1653
      A03 13540
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1910 CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XF2,ZF2)          A03 7380 1040
C
C     SHE= YF2
C     CALL FLAPI(NSF,WA,SHE,XTE,CF,CTAB,TAND, XF2,YF2,ZF2, COS3)   A03 7390 1041
C
C     CALL ISOMET(XF2,YF2,ZF2, REFL,XZER,YZER,ZZER)                 A03 7400 1042
C
C     WRITE (KT2)KREC,KWORD,XF2,YF2,ZF2                           A03 7410 1043
C
C     IF (K2-KX) 1920,1920,1950
1920 CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XF1,ZF1)          A03 7420 1044
C
C     SHE= YF1
C     CALL FLAPI(NSF,WA,SHE,XTE,CF,CTAB,TAND, XF1,YF1,ZF1, COS3)   A03 7430 1045
C
C     CALL ISOMET(XF1,YF1,ZF1, REFL,XZER,YZER,ZZER)                 A03 7440 1046
C
C     WRITE (KT2)KREC,KWORD,XF1,YF1,ZF1                           A03 7450 1047
C
C     GO TO 1950
C
1930 CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XF1,ZF1)          A03 7460 1048
C
C     SHE= YF1
C     CALL FLAPI(NSF,WA,SHE,XTE,CF,CTAB,TAND, XF1,YF1,ZF1, COS3)   A03 7470 1049
C
C     CALL ISOMET(XF1,YF1,ZF1, REFL,XZER,YZER,ZZER)                 A03 7480 1050
C
C     WRITE (KT2)KREC,KWORD,XF1,YF1,ZF1                           A03 7490 1051
C
C     GO TO 1950
C
1930 CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XF1,ZF1)          A03 7500 1052
C
C     SHE= YF1
C     CALL FLAPI(NSF,WA,SHE,XTE,CF,CTAB,TAND, XF1,YF1,ZF1, COS3)   A03 7510 1053
C
C     CALL ISOMET(XF1,YF1,ZF1, REFL,XZER,YZER,ZZER)                 A03 7520 1054
C
C     WRITE (KT2)KREC,KWORD,XF1,YF1,ZF1                           A03 7530 1055
C
C     GO TO 1950
C
1940 CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XF2,ZF2)          A03 7540 1056
C
C     SHE= YF2
C     CALL FLAPI(NSF,WA,SHE,XTE,CF,CTAB,TAND, XF2,YF2,ZF2, COS3)   A03 7550 1057
C
C     CALL ISOMET(XF2,YF2,ZF2, REFL,XZER,YZER,ZZER)                 A03 7560 1058
C
C     WRITE (KT2)KREC,KWORD,XF2,YF2,ZF2                           A03 7570 1059
C
C     GO TO 1950
C
1940 CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XF1,ZF1)          A03 7580 1060
C
C     SHE= YF1
C     CALL FLAPI(NSF,WA,SHE,XTE,CF,CTAB,TAND, XF1,YF1,ZF1, COS3)   A03 7590 1061
C
C     CALL ISOMET(XF1,YF1,ZF1, REFL,XZER,YZER,ZZER)                 A03 7600 1062
C
C     WRITE (KT2)KREC,KWORD,XF1,YF1,ZF1                           A03 7610 1063
C
C     GO TO 1950
C
1950 CONTINUE
1960 CONTINUE
C
C * RECORD 3 - FILE NSURF *
C
C     KREC= KREC +1
C     KWORD= 3
C     ITET = -1
C
C     DO 2010 K=2,K2
C
C     DO 2000 J=J1,J3
C
C     IF (ITET) 1970,1970,1980
1970 JR= J
GO TO 1990
1980 JR= J1+J3-J
1990 CONTINUE
C
C     WA = EW(JR,K)
C
C     CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2) A03 7700 1071
C
C     XF1 = EV(JR,K,1) - 0.25*EC(JR,K)
C     YF1 = EV(JR,K,2)
C     ZF1 = ZLE
C
C     CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XF1,YF1,ZF1)          A03 7710 1072
C
C     SHE = YF1
C     CALL FLAPI(NSF,WA,SHE,XTE,CF,CTAB,TAND, XF1,YF1,ZF1, COS3)   A03 7720 1073
C
C     CALL ISOMET(XF1,YF1,ZF1, REFL,XZER,YZER,ZZER)                 A03 7730 1074
C
C     WRITE (KT2)KREC,KWORD,XF1,YF1,ZF1                           A03 7740 1075
C
C     ITET= -ITET
C
2010 CONTINUE
C
C     END FILE KT2
C     LIN= LIN +2
C     WRITE (KOUT,11301KFILE)
C
C     2020 CONTINUE
C
C *** COMPUTE IMAGE VERTICAL SURFACES ***
C
C     IF (NREPET.EQ.0) GO TO 2060
NREPET= 0
IMAGEF(NSF)= 2*IMAGEF(NSF)
J1 = JN1(NSF)
J2 = JN2(NSF)
J3 = J2 +1
J1= J3
JSINGP(NSF)= J3
SYMGF(NSF)= 2.0
WINGD(NSF,6) = WINGD(NSF,6)*2.0
WINGD(NSF,10)= 0.0
DO 2050 J=J1,J3
J1= J1 +1
DO 2040 K=1,K2

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DO 2030 L=1,6          A03 8440      1146
EN(JI,K,L) = EN(J,K,L) A03 8450      1147
2030 EV(IJ,I,K,L) = EV(I,J,K,L) A03 8460      1148
FY(IJ,I,K) = FY(I,J,K) A03 8470      1149
ES(JI,K) = ES(J,K) A03 8480      1150
EW(IJ,I,K) = EW(I,J,K) A03 8490      1151
EC(IJ,I,K) = EC(I,J,K) A03 8500      1152
EN(IJ,K,2) = -EN(I,J,K,2) A03 8510      1153
EV(IJ,K,2) = -EV(I,J,K,2) A03 8520      1154
2040 CONTINUE          A03 8530      1155
2050 CONTINUE          A03 8540      1156
      JN2(NSF1)= JT -1 A03 8550      1157
      GD TO 1680          A03 8560      1158
C
C
2060 J1= JN2(NSF1) +2 A03 8570      1159
C
      RETURN          A03 8580      1160
C
      XXXXXX          A03 8590      1161
C
      END             A03 8600      1162
A03 8610      1163
A03 8620      1164
A03 8630      1165
A03 8640      1166

D FOR A04,A04          A04  10      1167
C
C
SUBROUTINE LIFTX(ALFA,ZHEIGT,SYMLF,NSURFL,NSURF2) A04  20      1168
C
* TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *A04  60      1169
* PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *A04  70      1170
C
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A04  80      1171
C
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A04  90      1172
C
DOUBLE PRECISION SCALE,SUP,DETERM,AMAT(100,100),VMAT(100) A04 100      1173
DIMENSION JNO(5)          A04 110      1174
DIMENSION SYMLF(5), SUMSL(4) A04 120      1175
DIMENSION P(3),B(3),D(3) A04 130      1176
DIMENSION COSL(3),COS2(3),COS3(3) A04 140      1177
DIMENSION PW(3),BW(3),DW(3) A04 150      1178
DIMENSION SUML(2,5,3),SUMR(2,5,3),SUMP(2,5,3),FACN(5,3) A04 160      1179
DIMENSION SUMLG(3),SUMPG(3),FACNG(3) A04 170      1180
DIMENSL(2,5,3),ZUMR(2,5,3),ZUMP(2,5,3) A04 180      1181
DIMENSL(2,5,3),ZUMLG(3),ZUMPG(3),ZACNG(3),ZUMSL(4) A04 190      1182
C
COMMON/DATA01/ KIN, KOUT, KTL, KT2, KT3, KREC, KFILE, LIN, LTKN
1 ,RAD, PIE, CUTNPL, CUTOF2, DELALF, LFLAP, LDRAG, COLOCN
2 ,IFLG(20), EXECK(15) A04 200      1183
C
COMMON/DATA02/ NWING, NFUS, NVTAIL, NSS(5), NSSO(5), NCS(5)
1 ,X(30), Y(30), Z(30), E(30), XCER(30), FLAPC(30), TABC(30) A04 210      1184
2 ,WSMOTH, EWF(30), ELE(30), ETE(30), EHE(30), EHEE(30) A04 220      1185
3 ,XOC(10,5), ZOC(10,30) A04 230      1186
COMMON/DATA22/ IMAGEF(5),JSINGP(5) A04 240      1187
C
COMMON/DATA03/ FLAPDJ(5),TABDJ(5),AILDJ(2,5),DELTFL(5),DELTFT(5)
1 ,WFF1(5), WFF12(5), WFF2(5), WFF22(5), WFF3(5) A04 250      1188
2 ,WFLAP1(5), WFLAP2(5), WFLAP3(5) A04 260      1189
C
COMMON/DATA04/ WING(5,16), JN1(5), JN2(5), KN2(5), SYMGF(5), NSURFL(5)
1 ,EW(60,10), EY(60,10), EC(60,10), ES(60,10), EG(60,10) A04 270      1190
2 ,EN(60,10,6), EV(60,10,6), VVINOX(60,10,3) A04 280      1191
C
COMMON/DATA05/XCG,YCG,ZCG,REFS,REFC,REFB A04 290      1192
C
1000 FORMAT(1X)          A04 300      1193
1010 FORMAT(1X,/,1X)      A04 310      1194
C
1020 FORMAT(34X,41HVORTEX LATTICE MATRIX DETAIL-SURFACE NO.=,I2,2H/I,12) A04 320      1195
1 ,I1H,I2,I1H,/,34X,51(IH*),/,1X) A04 330      1196
1030 FORMAT(1X,12H J K NP NO,
2 60H VFS(MAT)  VIN(MAT) P(X)    P(Y)    P(Z)    B(X)    ,
3 50H R(Y)     D(X)    D(Y)    D(Z)    ,/,1X) A04 340      1197
1040 FORMAT(1X,41I10.4)      A04 350      1198
C
1050 FORMAT(36X,37HLIFT DISTRIBUTION DETAIL-SURFACE NO.=,I2,2H/I,12,
1 ,I1H,I2,I1H,/,34X,47(IH*),/,1X) A04 360      1199
1060 FORMAT(3X,4HJ K,5X,40HP(X)   P(Y)    P(Z)    AREA   ,
160HCPN G(X)   G(Y)    G(Z)    VI(X)   VI(Y)   ,
215HVI(Z)  GAMMA   ,/,1X) A04 370      1200
1070 FORMAT(1X, 213, 3F10.3, 2F10.4, 6F10.5, E10.4 ) A04 380      1201
C
1080 FORMAT(34X,41HSECTION AIRLOAD COEFFICIENTS-SURFACE NO.=,I2,2H/I,12) A04 390      1202
1 ,I1H,I2,I1H,/,34X,51(IH*),/,1X) A04 400      1203
1090 FDRNAT(3X,52H) Y*      Y      Z      W      SCN      SCX, A04 410      1204
1 6X,58HSCL SCD      SMP C/4  SCLC/R  1XL      1YL      1ZL ,A04 420      1205
2 /,1X ) A04 430      1206
1100 FDRMAT(1X,I3,F8.4,3F9.3,6F9.4,3F9.4) A04 440      1207
C
1110 FORMAT(//,34X,45HINTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS.=,I2) A04 450      1208
1 ,2K -,12,/,34X,51(IH*),/,1X) A04 460      1209
2 54H FCL      ECD      ECMP      ECMR      ECY, A04 470      1210
3 33H FZA      ES      EMGC      ER,/, 1X) A04 480      1211
1120 FORMAT(1X,I2,  RF9.4, 5F9.2 1) A04 490      1212
C
1130 FORMAT(1X,/,49X,20H*** AIRLOAD SUMS ***,/,1X)
* 3H AC,BF9.4,5F9.2, /,3H CG,BF9.4,5F9.2, A04 500      1213
* 4H AC ,BF9.4,1H*,5(F8.2,1H*),/4H CG ,8(F8.4,1H*),5(F8.2,1H*) A04 510      1214
1 //,37X,14H* DETERMINANT=,E10.4,9H * SCALE=,E10.4,2H *,/,1X) A04 520      1215
1140 FORMAT(1X,I2,1X,E(F8.4,1H*),5(F8.2,1H*)) A04 530      1216
C
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A04 540      1217
C
      XXXXXX          A04 550      1218
C
      END             A04 560      1219
A04 570      1220
A04 580      1221
A04 590      1222
A04 600      1223
A04 610      1224
A04 620      1225
A04 630      1226
A04 640      1227
A04 650      1228
A04 660      1229
A04 670      1230
A04 680      1231
A04 690      1232
A04 700      1233
A04 710      1234
A04 720      1235
A04 730      1236
A04 740      1237
A04 750      1238
A04 760      1239
A04 770      1240
A04 780      1241
A04 790      1242
A04 800      1243
A04 810      1244
A04 820      1245
C
      XXXXXX          A04 830      1246
C
      END             A04 840      1247
C
      XXXXXX          A04 850      1248

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```

C * INITIALIZE *
C
C   ALFAR = ALFA/RAD
C   TANA = TAN(ALFAR)
C   COSA = 1.0/SQRT(1.0+TANA**2)
C   SINA = TANA*COSA
C   TANV = -TAN(1.5*ALFAR)
C   TANVG = -TAN(1.5*ALFAR)
C   UNIT = 0.25/PIE
C   UNITG = -UNIT
C
C   DO 1160 NSF=NSURF1,NSURF2
C
C   NZERO= JN1(NSF)
C   TEST= SYMLF(NSF)
C   IF (TEST) 1150,1150,1160
C   1150 NZERO= IMAGEF(NSF)/2 + NZERO
C   IF(JSINGP(NSF).NE.0) NZERO= NZERO +1
C   1160 JNO(NSF)= NZERO
C
C   * CALCULATE MATRICES VMAT(NV) & AMAT(NG,NV) *
C
C   NV = 0
C
C   DO 1520 NSF=NSURF1,NSURF2
C
C   K= NSF + 5
C   J1 = JN1(NSF)
C   J2 = JN2(NSF)
C   K2 = KN2(NSF)
C   NZERO = JNO(NSF)
C   NSPV= IMAGEF(NSF)
C   NCV = IFLGK()
C   NM = 0
C   NOO= NSSO(NSF)
C
C   DO 1480 KV=1,K2
C   DO 1450 JV=NZERO,J2
C   IF (JSINGP(NSF).EQ.JV) GO TO 1450
C   NV= NV+1
C
C   SYMGF2= SYMGF(NSF)-1.0
C   SYMGF3=-SYMGF(NSF)+2.0
C
C   COS1(1)= COSA
C   COS1(2)= 0.0
C   COS1(3)= -SINA
C
C   DO 1170 L=1,3
C   LP3= L +3
C   COS2(L)= EN(JV,KV,LP3)
C   1170 P(L)= EN(JV,KV,L)
C
C   JP1= JV +1
C   WA = EME(NO0)
C   TEST= ABS( EW(JV,KV) - EW(JP1,KV) ) - 0.001
C   IF (TEST) 1190,1190,1180
C   1180 WA = (EW(JV,KV) + EW(JP1,KV) ) /2.0
C   1190 CONTINUE
C   SHE = EN(JV,KV,2)
C
C   CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CM,CF,CTAB,TAND,TANS,RATS,M1,M2)
C   CALL FLAPSINSF(WA,SHE,XTE,CF,CTAB,TAND, P,COS2)
C   CALL DOTP(COS1,COS2,VMATDP)
C
C   VMAT(NV)= VMATDP
C
C   DO 1200 L=1,3
C   1200 COS1(L)= COS2(L)
C
C   NG= 0
C   DO 1440 NSR=NSURF1,NSURF2
C
C   J0 = JNO(NSR)
C   J3 = JN1(NSR)
C   J4 = JN2(NSR)
C   K4 = KN2(NSR)
C
C   SYMGF2 = SYMGF(NSR) -1.0
C   SYMGF3 =-SYMGF(NSR) + 2.0
C   SYMLDG = SYMLF(NSR)
C
C   DO 1430 KG=1,K4
C
C   NV = 0
C
C   DO 1520 NSF=NSURF1,NSURF2
C
C   K= NSF + 5
C   J1 = JN1(NSF)
C   J2 = JN2(NSF)
C   K2 = KN2(NSF)
C   NZERO = JNO(NSF)
C   NSPV= IMAGEF(NSF)

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NCV = 1FLG(K)
NM = 0
NOO= NS50(NSF)

C
C
C
DO 1480 KV=L,K2
DO 1450 JV=NZERO,J2
IF (JSINGP(NSF).EQ.JV) GO TO 1450
NV= NV+1
C
SYMGF2= SYMGF(NSF)-1.0
SYMGF3= SYMGF(NSF)+2.0
C
COS1(1)= COSA
COS1(2)= D_0
COS1(3)= -SINA
C
DO 1170 L=1,3
LP3= L +3
COS2(L)= EN(JV,KV,LP3)
1170 P(L)= EN(JV,KV,L)
C
JP1= JV +1
WA = EW(IND0)
TEST= ABS( EW(JV,KV) - EW(JP1,KV) ) - 0.001
IF (TEST .LT. 0.001) GO TO 1180
1180 WA = (EW(JV,KV) + EW(JP1,KV))/2.0
1190 CONTINUE
SHE = EN(JV,KV,2)
C
CALL CORDF(WA,YA,XLF,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
CALL FLAPS(NSF,WA,SHE,XTE,CF,CTAB,TAND,          P,COS2)
CALL DOTP(COS1,COS2,VMATDP)
C
VMATINV= VMATDP
C
C
DO 1200 L=1,3
1200 COS1(L)= COS2(L)
C
C
NG= 0
DO 1440 NSR=NSURFL,NSURF2
C
JO = JNO(NSR)
J3 = JN1(NSR)
J4 = JN2(NSR)
K4 = KN2(NSR)
C
SYMGF2 = SYMGF(NSR) - 1.0
SYMGF3 = SYMGF(NSR) + 2.0
SYMLDG = SYMLF(NSR)
C
DO 1430 KG=1,K4
DO 1420 JG=JO,J4
IF (JSINGP(NSR).EQ.JG) GO TO 1420
NG= NG+1
C
JP1 = JG+1
WA = EW(JG,KG)
C
DO 1210 L=1,3
LP3= L +3
B(L)= EV(JG,KG,L)
1210 D(L)= EV(JP1,KG,L)
C
SHE = B(2)
C
CALL CORDF(WA,YA,XLF,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
CALL FLAPS(NSR,WA,SHE,XTE,CF,CTAB,TAND,          B,COS3)
C
WA = EW(JP1,KG)
SHE = D(2)
C
CALL CORDF(WA,YA,XLF,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
CALL FLAPS(NSR,WA,SHE,XTE,CF,CTAB,TAND,          D,COS3)
C
DO 1220 L=1,3
P(L)= P(L)
B(L)= B(L)
1220 D(L)= D(L)
C
CALL VORTEX(P,B,D,TANV,UNIT,  V1,COS2)
CALL DOTP(COS1,COS2,SUM1)
C
SUM1= SUM1*V1
SUM2 = 0.0
C
IF (1FLG(17)-1) 1240,1230,1230
1230 CONTINUE
C
CALL REFLEC(R,ZHEIGHT,ALFAR,COSA)
CALL REFLEC(D,ZHEIGHT,ALFAR,COSA)
C
CALL VORTEX(P,B,D,TANVG,UNITG,  V1,COS2)
CALL DOTP(COS1,COS2,SUM3)
C
SUM1= SUM1 + SUM3*V1
1240 CONTINUE
C
ITEST= J3 - JO
IF (ITEST) 1250,1300,1300

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1250 JH = J3 + J4 - JG          A04 2950    1461
      IF(JSINGP(NSR).NE.0) JH= JG-JO+J3
      IF (JH-JG) 1260,1300,1300
1260 CONTINUE
C
      JP1 = JH +1
      WA= EW1JH,KG1
C
      DO 1270 L=1,3
      LP3= L +3
      B(L)= EV1JH,KG,L
1270 DELI= EV1JP1,KG,L
C
      SHE = B(1)
C
      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
      CALL FLAPS(NSR,WA,SHE,XTE,CF,CTAB,TAND,B,COS3)
C
      WA = EW1JP1,KG1
      SHE = O(2)
C
      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
      CALL FLAPS(NSR,WA,SHE,XTE,CF,CTAB,TAND,D,COS3)
C
      IF(JSINGP(NSR).LE.JH.OR.JO.LE.J3)
      * CALL VORTEX1 P,B,D, TANV,UNIT, VI,COS2 )
      IF(JSINGP(NSR).GT.JH.AND.JO.GT.J3)
      * CALL VORTEX1 P,D,B, TANV,UNIT, VI,COS2 )
      CALL DOTP(COS1,COS2,SUM2)
C
      SUM2= SUM2*VI
C
      IF (IFLG(17)-1) 1290,1280,1280
1280 CONTINUE
C
      CALL REFLEC1B,ZHEIGHT,ALFAR,COSA)
      CALL REFLEC1D,ZHEIGHT,ALFAR,COSA)
C
      IF(JSINGP(NSR).LE.JH.OR.JO.LE.J3)
      * CALL VORTEX1 P,B,D, TANV,UNIT, VI,COS2 )
      IF(JSINGP(NSR).GT.JH.AND.JO.GT.J3)
      * CALL VORTEX1 P,D,B, TANV,UNIT, VI,COS2 )
      CALL DOTP(COS1,COS2,SUM4)
C
      SUM2= SUM2 + SUM4*VI
C
1290 CONTINUE
C
1300 CONTINUE
C
      AMAT(NG,NV) = SUM1 + SUM2
C
C
      IF (EXECK(15)-1.0) 1310,1410,1410
1310 IF (IFLG(20)-5) 1410,1320,1320
1320 IF (NM-1) 1330,1330,1390
1330 LIN= LIN +4
      NM= 10
      IF (LINX-LIN) 1340,1350,1350
1340 CALL PAGE
      LIN= LIN +4
1350 WRITE (KOUT,1020)NSF,NSURF1,NSURF2
1360 LIN= LIN +2
      IF (LINX-LIN) 1370,1380,1380
1370 CALL PAGE
      LIN= LIN +2
1380 WRITE (KOUT,1030)
1390 LIN= LIN +1
      IF (LINX-LIN) 1370,1400,1400
1400 WRITE (KOUT,1040)JV,KV,NV,NG,VMAT(NV),AMAT(NG,NV),(PW(I),I=1,31),/8A04 3650
      1W(I),I=1,3),(DW(I),I=1,3)
1410 CONTINUE
C
C
      1420 CONTINUE
      1430 CONTINUE
      1440 CONTINUE
C
      CALL ABORTJ(4,SUM1,NG)
C
C
      1450 CONTINUE
C
      IF (EXECK(15)-1.0) 1460,1480,1480
1460 IF (IFLG(20)-5) 1480,1470,1470
1470 WRITE (KDUT,1000)
      LIN= LIN +1
1480 CONTINUE
C
      LIN= LIN +3
      IF (LINX-LIN) 1490,1500,1500
1490 CALL PAGE
      GO TO 1510
1500 WRITE (KDUT,1010)
1510 CONTINUE
C
      1520 CONTINUE
C
      * SOLVE FOR GAMMA *

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```

NM= 0
SUP= 0.0
DO 1540 J=1,NV
DO 1530 K=1,NG
NM= NM+1
1530 SUP= SUP + DA3SI AMAT(K,J) 1
1540 CONTINUE
C      SCALE = FLOAT(NM)
C      SCALE = SUP/SCALE
C      DO 1560 J=1,NV
C      DO 1550 K=1,NG
1550 AMAT(J,K)= AMAT(J,K)/SCALE
1560 CONTINUE
C      CALL DMATIN(AMAT,NV,DETERM)
C      NG= 0
DO 1640 NSR=NSURF1,NSURF2
C      JD = JNO(NSR)
J3 = JN1(NSR)
J4 = JN2(NSR)
K4 = KN2(NSR)
C      DO 1630 K=1,K4
DO 1620 J=JD,J4
IF (JSINGP(NSR).EQ.J) GO TO 1620
NG=NG+1
C      SUP= 0.0
NV= 0
DO 1590 NSF=NSURF1,NSURF2
C      NZERO= JNO(NSF)
J1 = JN1(NSF)
J2 = JN2(NSF)
K2 = KN2(NSF)
C      DO 1580 KV=1,K2
DO 1570 JV=NZERO,J2
IF (JSINGP(NSF).EQ.JV) GO TO 1570
NV=NV+1
SUP = SUP - VMAT(NV)*AMAT(NV,NG)
1570 CONTINUE
1580 CONTINUE
1590 CONTINUE
C      SUP = SUP/SCALE
SUM = -SUP
C      EGI(J,K)= SUM/FXECK(J)
C      ITEST= J3 - J0
IF (ITEST) 1600,1620,1620
1600 JH = J3 + J4 - J
IF (JSINGP(NSR).NE.0) JH= J - J0 + J3
IF (JH-J) 1610,1620,1620
1610 EGI(JH,K)= EGI(J,K)
1620 CONTINUE
1630 CONTINUE
1640 CONTINUE
C      * SOLVE FOR INDUCED VELOCITY MATRIX *
C      DO 1800 NSF=NSURF1,NSURF2
C      NZERO= JNO(NSF)
J1 = JN1(NSF)
J2 = JN2(NSF)
K2 = KN2(NSF)
C      DO 1790 KV=1,K2
DO 1780 J=NZERO,J2
IF (JSINGP(NSF).EQ.J) GO TO 1780
C      JP1= J + 1
WA = EW(J,K)
SYMGF2= SYMGF(NSF) -1.0
SYMGF3= SYMGF(NSF) +2.0
SYMLDG= SYMLF(NSF)
C      DO 1650 L=1,3
LP3= L + 3
SUMSL(L)= 0.0
R(L)= EV(J,L,K)
1650 D(L)= EV(JP1, K,L)
C      SHE = R(2)
CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
CALL FLAPSINSF ,WA,SHE,XTE,CF,CTAB,TAND,B,COS3)
C      WA = EW(JP1,KG)
SHE = D(2)
CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
CALL FLAPSINSF ,WA,SHE,XTE,CF,CTAB,TAND,D,COS3)
C      DO 1660 L=1,3
A04 4010 1567
A04 4020 1568
A04 4030 1569
A04 4040 1570
A04 4050 1571
A04 4060 1572
A04 4070 1573
A04 4080 1574
A04 4090 1575
A04 4100 1576
A04 4110 1577
A04 4120 1578
A04 4130 1579
A04 4140 1580
A04 4150 1581
A04 4160 1582
A04 4170 1583
A04 4180 1584
A04 4190 1585
A04 4200 1586
A04 4210 1587
A04 4220 1588
A04 4230 1589
A04 4240 1590
A04 4250 1591
A04 4260 1592
A04 4270 1593
A04 4280 1594
A04 4290 1595
A04 4300 1596
A04 4310 1597
A04 4320 1598
A04 4330 1599
A04 4340 1600
A04 4350 1601
A04 4360 1602
A04 4370 1603
A04 4380 1604
A04 4390 1605
A04 4400 1606
A04 4410 1607
A04 4420 1608
A04 4430 1609
A04 4440 1610
A04 4450 1611
A04 4460 1612
A04 4470 1613
A04 4480 1614
A04 4490 1615
A04 4500 1616
A04 4510 1617
A04 4520 1618
A04 4530 1619
A04 4540 1620
A04 4550 1621
A04 4560 1622
A04 4570 1623
A04 4580 1624
A04 4590 1625
A04 4600 1626
A04 4610 1627
A04 4620 1628
A04 4630 1629
A04 4640 1630
A04 4650 1631
A04 4660 1632
A04 4670 1633
A04 4680 1634
A04 4690 1635
A04 4700 1636
A04 4710 1637
A04 4720 1638
A04 4730 1639
A04 4740 1640
A04 4750 1641
A04 4760 1642
A04 4770 1643
A04 4780 1644
A04 4790 1645
A04 4800 1646
A04 4810 1647
A04 4820 1648
A04 4830 1649
A04 4840 1650
A04 4850 1651
A04 4860 1652
A04 4870 1653
A04 4880 1654
A04 4890 1655
A04 4900 1656
A04 4910 1657
A04 4920 1658
A04 4930 1659
A04 4940 1660
A04 4950 1661
A04 4960 1662
A04 4970 1663
A04 4980 1664
A04 4990 1665
A04 5000 1666
A04 5010 1667
A04 5020 1668
A04 5030 1669
A04 5040 1670
A04 5050 1671
A04 5060 1672

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1660 P(L)= 0.5*( B(L)+D(L) )
C
C      DO 1740 NSR=NSURF1,NSURF2
C
C        J0 = JN0(NSR)
C        J3 = JN1(NSR)
C        J4 = JN2(NSR)
C        K4 = KN2(NSR)
C        SYMGF2= SYMGF(NSR) -1.0
C        SYMGF3=-SYMGF(NSR) +2.0
C
C        DO 1730 KG=L,K4
C        DO 1720 JG=J3,J4
C        IF (JSINGP(NSR).EQ.JG) GO TO 1720
C
C          JP1= JG +1
C          WA = EW(JG,KG)
C
C          DO 1670 L=L,3
C          LP3= L +3
C          B(L)= EV(JG,KG,L)
C          L670 D(L)= EV(JP1,KG,L)
C
C          SHE = B(2)
C
C          CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
C          CALL FLAPSINSF(WA,SHE,XTE,CF,CTAB,TAND,B,COS3)
C
C          WA = EW(JP1,KG)
C          SHE = D(2)
C
C          CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
C          CALL FLAPS(NSF,WASHE,XTE,CF,CTAB,TAND,D,COS3)
C
C          CALL VORTEX(P,B,D,TANV,UNIT,VI,COS2)
C
C          DO 1680 L=1,3
C          1680 SUMSL(L)= SUMSL(L) - EG(JG,KG)*VI*COS2(L)
C
C          IF (IFLG(17)-1) 1710,1690,1690
C          1690 CONTINUE
C
C          CALL REFLEC(B,ZHEIGHT,ALFAR,COSA)
C          CALL REFLECI(ZHEIGHT,ALFAR,COSA)
C
C          CALL VORTEX(P,B,D,TANVG,UNIT,BG,VI,COS2)
C
C          DO 1700 L=1,3
C          1700 SUMSL(L)= SUMSL(L) - EG(JG,KG)*VI*COS2(L)
C          1710 CONTINUE
C
C          1720 CONTINUE
C          1730 CONTINUE
C          1740 CONTINUE
C
C          DO 1750 L=1,3
C          1750 VVINDX(J,K,L)= SUMSL(L)*EXECK(L)
C
C          ITEST= J1 - NZERC
C          IF (ITEST) 1760,1780,1780
C          1760 JH= J1 +J2 - J
C          IF (JSINGP(NSF).NE.0) JH= J -NZERO +JI
C          IF (JH=J) 1770,1780,1780
C          1770 CONTINUE
C
C          VVINDX(JH,K,1) = VVINDX(J,K,1)
C          VVINDX(JH,K,2) = -VVINDX(J,K,2)
C          VVINDX(JH,K,3) = VVINDX(J,K,3)
C
C          1780 CONTINUE
C          1790 CONTINUE
C          1800 CONTINUE
C
C
C ** LIFTING SURFACES AIRLOAD COEFFICIENTS **
C
C          DO 1830 L=1,3
C          ZUMLG(L)= 0.0
C          ZUMPG(L)= 0.0
C          ZACNG(L)= 0.0
C          SUMLG(L)= 0.0
C          SUMPG(L)= 0.0
C          FACNG(L)= 0.0
C
C          DO 1820 M=1,2
C          DO 1810 N=1,5
C          ZUML(M,N,L)= 0.0
C          ZUMR(M,N,L)= 0.0
C          ZUMP(M,N,L)= 0.0
C          SUML(M,N,L)= 0.0
C          SUMR(M,N,L)= 0.0
C          1810 SUMP(M,N,L)= 0.0
C
C          1820 CONTINUE
C          1830 CONTINUE
C
C          DO 1840 N=1,NSURF
C          FACN(N,1)= 2.0/WINGD(N,6)
C          FACN(N,2)= FACN(N,1)/WINGD(N,9)
C          1840 FACN(N,3)= FACN(N,1)/WINGD(N,1)
C          FACNG(1)= 2.0/REFS
C          FACNG(2)= FACNG(1)/REFC
C          FACNG(3)= FACNG(1)/REFB
C
C          A04 5070 1673
C          A04 5080 1674
C          A04 5090 1675
C          A04 5100 1676
C          A04 5110 1677
C          A04 5120 1678
C          A04 5130 1679
C          A04 5140 1680
C          A04 5150 1681
C          A04 5160 1682
C          A04 5170 1683
C          A04 5180 1684
C          A04 5190 1685
C          A04 5200 1686
C          A04 5210 1687
C          A04 5220 1688
C          A04 5230 1689
C          A04 5240 1690
C          A04 5250 1691
C          A04 5260 1692
C          A04 5270 1693
C          A04 5280 1694
C          A04 5290 1695
C          A04 5300 1696
C          A04 5310 1697
C          A04 5320 1698
C          A04 5330 1699
C          A04 5340 1700
C          A04 5350 1701
C          A04 5360 1702
C          A04 5370 1703
C          A04 5380 1704
C          A04 5390 1705
C          A04 5400 1706
C          A04 5410 1707
C          A04 5420 1708
C          A04 5430 1709
C          A04 5440 1710
C          A04 5450 1711
C          A04 5460 1712
C          A04 5470 1713
C          A04 5480 1714
C          A04 5490 1715
C          A04 5500 1716
C          A04 5510 1717
C          A04 5520 1718
C          A04 5530 1719
C          A04 5540 1720
C          A04 5550 1721
C          A04 5560 1722
C          A04 5570 1723
C          A04 5580 1724
C          A04 5590 1725
C          A04 5600 1726
C          A04 5610 1727
C          A04 5620 1728
C          A04 5630 1729
C          A04 5640 1730
C          A04 5650 1731
C          A04 5660 1732
C          A04 5670 1733
C          A04 5680 1734
C          A04 5690 1735
C          A04 5700 1736
C          A04 5710 1737
C          A04 5720 1738
C          A04 5730 1739
C          A04 5740 1740
C          A04 5750 1741
C          A04 5760 1742
C          A04 5770 1743
C          A04 5780 1744
C          A04 5790 1745
C          A04 5800 1746
C          A04 5810 1747
C          A04 5820 1748
C          A04 5830 1749
C          A04 5840 1750
C          A04 5850 1751
C          A04 5860 1752
C          A04 5870 1753
C          A04 5880 1754
C          A04 5890 1755
C          A04 5900 1756
C          A04 5910 1757
C          A04 5920 1758
C          A04 5930 1759
C          A04 5940 1760
C          A04 5950 1761
C          A04 5960 1762
C          A04 5970 1763
C          A04 5980 1764
C          A04 5990 1765
C          A04 6000 1766
C          A04 6010 1767
C          A04 6020 1768
C          A04 6030 1769
C          A04 6040 1770
C          A04 6050 1771
C          A04 6060 1772
C          A04 6070 1773
C          A04 6080 1774
C          A04 6090 1775
C          A04 6100 1776
C          A04 6110 1777
C          A04 6120 1778

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C          A04 6130    1779
C          A04 6140    1780
C          A04 6150    1781
C          A04 6160    1782
C          A04 6170    1783
C          A04 6180    1784
C          A04 6190    1785
C          A04 6200    1786
C          A04 6210    1787
C          A04 6220    1788
C          A04 6230    1789
C          A04 6240    1790
C          A04 6250    1791
C          A04 6260    1792
C          A04 6270    1793
C          A04 6280    1794
C          A04 6290    1795
C          A04 6300    1796
C          A04 6310    1797
C          A04 6320    1798
C          A04 6330    1799
C          A04 6340    1800
C          A04 6350    1801
C          A04 6360    1802
C          A04 6370    1803
C          A04 6380    1804
C          A04 6390    1805
C          A04 6400    1806
C          A04 6410    1807
C          CALL CORDF(W1,Y1,XL1,XT1,ZL1,EPL,CFL,CBL,TAD1,TAS1,RATS,M1,M2)A04 6420 1808
C          CALL CORDF(W2,Y2,XL2,XT2,ZL2,EP2,CFL,CBL,TAD2,TAS2,RATS,M1,M2)A04 6430 1809
C          CALL CORDF(WA,YA,XLE,XTE,ZLE,EP3,CW,CF,CFAR,TAND,TASD,RATS,M1,M2)A04 6440 1810
C          A04 6450    1811
C          TANL= (XL2-XL1)/C.0001
C          TAND= (ZL2-ZL1)/0.0001
C          FOSLE= ABS(Y2-Y1)/0.0001
C          IF(FOSLE.GT.0.0001) TANL= TANL/FOSLE
C          IF(FOSLE.GT.0.0001) TAND = TAND/FOSLE
C          IF(TEST.LT.0.0) TANL= 0.0
C          IF(TEST.LT.0.0) TAND = 0.0
C          FOSLE = SQR(1.0 + TANL**2)
C          XHE = 0.5*( XT1+XT2 - CFL-CFL )
C          XHEE = 0.5*( XT1+XT2 - CBL-CBL )
C          COSD = 1.0/SQR( 1.0 + TAND**2 )
C          SIND= 1.0
C          IF(TAND.LT.0) SIND= -1.0
C          IF(COSD.GT.0.00001) SIND= TAND*COSD
C          CW = 0.5*( CW1+CW2 )
C          DO 1860 L=1,4
C          1870 ZUMSL(L) = 0.0
C          DO 2040 K=1,K2
C          NM= NM +1
C          COSI(L)= VVINDX(J,K,1) + COSA
C          COSI(2)= VVINDX(J,K,2)
C          COSI(3)= VVINDX(J,K,3) - STNA
C          DO 1880 L=1,3
C          B(L)= EV(J,K,L)
C          1880 D(L)= EV(JP1,K,L)
C          SH1 = B(2)
C          SH2 = D(2)
C          CALL FLAPS(NSF,W1,SH1,XT1,CFL,CBL,TAD1,      B,COS3)
C          CALL FLAPS(NSF,W2,SH2,XT2,CFL,CBL,TAD2,      D,COS3)
C          SUMB = 0.0
C          DO 1890 L=1,3
C          P(L)= 0.5*( B(L) + D(L) )
C          COS2(L)= D(L)-B(L)
C          IF(JISINGP(NSF).GT.J.AND.JNO(NSF).GT.J1) COS2(L)= -COS2(L)
C          1890 SUMB = SUMB + COS2(L)**2
C          SUMB = SQR(SUMB)
C          DO 1900 L=1,3
C          1900 COS2(L1) = COS2(L)/SUMB
C          CALL CROSP(COSI1,COS2,COS3)
C          SLIFT= EG(J,K)*SUMB
C          IF SLIFT= EG(J,K)*SUMB
C          DO 1910 L=1,3
C          SUMSL(L)= SLIFT*COS3(L)
C          ZUMSL(L) = ZUMSL(L) + SUMSL(L)
C          SUMLG(L)= SUMLG(L) + SUMSL(L)
C          SUML(1,NSF,L)= SUML(1,NSF,L) + SUMSL(L)
C          1910 SUML(2,NSF,L)= SUML(1,NSF,L)
C          X1 = P(1) - WINGD(NSF,11)
C          X2 = P(2)
C          X3 = P(3) - WINGD(NSF,12)
C          SUMP(1,NSF,1)= SLMP(1,NSF,1) + ( X1*SUMSL(3) - X3*SUMSL(1) )
C          SUMP(1,NSF,2)= SLMP(1,NSF,2) - ( X2*SUMSL(3) - X3*SUMSL(2) )
C          SUMP(1,NSF,3)= SLMP(1,NSF,3) - ( X2*SUMSL(1) - X1*SUMSL(2) )
C          X1 = P(1) - WINGD(1,11)
C          X2 = P(2)
C          X3 = P(3) - WINGD(1,12)
C          SUMP(2,NSF,1)= SLMP(2,NSF,1) + ( X1*SUMSL(3) - X3*SUMSL(1) )

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        SUMP(2,NSF,2)= SLMP(2,NSF,2) - ( X2*SUMSL(3) - X3*SUMSL(2) )      A04 7190    1885
        SUMP(2,NSF,3)= SLMP(2,NSF,3) - ( X2*SUMSL(1) - X1*SUMSL(2) )      A04 7200    1886
C       X1 = P(1) - XCG
C       X2 = P(2) - YCG
C       X3 = P(3) - ZCG
C
C       SUMPG(1)= SUMPG(1) + ( X1*SUMSL(3) - X3*SUMSL(1) )
C       SUMPG(2)= SUMPG(2) - ( X2*SUMSL(3) - X3*SUMSL(2) )
C       SUMPG(3)= SUMPG(3) - ( X2*SUMSL(1) - X1*SUMSL(2) )
C
C       SUMB= 0.0
C       DO 1920 L=1,3
1920  SUMB= SUMB + SUMSL(L)**2
        SUMSL(4)= SQRT(SUMB)
        DO 1930 L=1,3
1930  SUMSL(L)= SUMSL(L)/SUMSL(4)
C
C
C       IF (EXECK(15)-1.C) 1940,2030,2030
1940  IF (IFLG(20)-2) 2030,1950,1950
1950  IF (NM-1) 1960,1960,2010
1960  LIN = LIN +4
        NM = 10
        IF (LINX-LIN) 1970,1980,1980
1970  CALL PAGE
        LIN= LIN +4
1980  WRITE (KOUT,1050)NSF,NSURF1,NSURF2
        LIN= LIN +2
        IF (LINX-LIN) 1950,2000,2000
1990  CALL PAGE
        LIN= LIN +2
2000  WRITE (KOUT,1060)
2010  LIN= LIN +1
        IF (LINX-LIN) 1950,2020,2020
2020  CPLIFT = -2.0*SLIFT/FS(J,K)
        WRITE (KOUT,1070)J,K,(P(I),I=1,31),ESIJ,J,K),CPLIFT,(COS3(I)),I=1,31,(A04 7560
        1VINDXJ,K,I),I=1,31),EG(J,K)
2030  CONTINUE
C
C
2040  CONTINUE
C
        P(1) = XLE
        P(3) = ZLE
C
SCTS = ZUMSL(1)
        IF(SCTS.GT.0.0) SCTS= 0.0
SNFC = ABS(FOSLE*SCTS)
        IF(ZUMSL(3).LT.0.0) SNFC= -SNFC
ZUMSL(1)= -SCTS
ZUMSL(2)= SCTS*TANLE
ZUMSL(3)= SNFC
C
        X1 = P(1) - WINGD(NSF,L1)
        X2 = P(2)
        X3 = P(3) - WINGD(NSF,L2)
C
ZUMP(1,NSF,1)= ZLMP(1,NSF,1) + ( X1*ZUMSL(3) - X3*ZUMSL(1) )      A04 7780    1944
ZUMP(1,NSF,2)= ZLMP(1,NSF,2) - ( X2*ZUMSL(3) - X3*ZUMSL(2) )      A04 7790    1945
ZUMP(1,NSF,3)= ZLMP(1,NSF,3) - ( X2*ZUMSL(1) - X1*ZUMSL(2) )      A04 7800    1946
C
        X1 = P(1) - WINGD(1,11)
        X2 = P(2)
        X3 = P(3) - WINGD(1,12)
C
ZUMP(2,NSF,1)= ZUMP(2,NSF,1) + ( X1*ZUMSL(3) - X3*ZUMSL(1) )      A04 7860    1952
ZUMP(2,NSF,2)= ZUMP(2,NSF,2) - ( X2*ZUMSL(3) - X3*ZUMSL(2) )      A04 7870    1953
ZUMP(2,NSF,3)= ZUMP(2,NSF,3) - ( X2*ZUMSL(1) - X1*ZUMSL(2) )      A04 7880    1954
C
        X1 = P(1) - XCG
        X2 = P(2) - YCG
        X3 = P(3) - ZCG
C
ZUMPG(1)= ZUMPG(1) + ( X1*ZUMSL(3) - X3*ZUMSL(1) )
ZUMPG(2)= ZUMPG(2) - ( X2*ZUMSL(3) - X3*ZUMSL(2) )
ZUMPG(3)= ZUMPG(3) - ( X2*ZUMSL(1) - X1*ZUMSL(2) )
C
        DO 2050 L=1,3
ZUMLG(L)= ZUMLG(L) + ZUMSL(L)
ZUML(1,NSF,L)= ZUML(1,NSF,L) + ZUMSL(L)
2050  ZUML(2,NSF,L)= ZUML(1,NSF,L)
C
        IF (EXECK(15)-1.C) 2060,2100,2100
2060  IF (IFLG(20)-2) 2100,2070,2070
2070  LIN= LIN +2
        IF (LINX-LIN) 2080,2090,2090
2080  CALL PAGE
        GO TO 2100
2090  WRITE (KOUT,1000)
        WRITE (KOUT,1000)
2100  CONTINUE
C
C
        SUMR(1,NSF,1) = ( SUML(1,NSF,1)*COSA - SUML(1,NSF,3)*SINA )
        SUMR(1,NSF,2) = SUML(1,NSF,2)
        SUMR(1,NSF,3) = (-SUML(1,NSF,3)*COSA - SUML(1,NSF,1)*SINA )
C
        SUMR(2,NSF,1) = SUMR(1,NSF,1)
        SUMR(2,NSF,2) = SUMR(1,NSF,2)
        SUMR(2,NSF,3) = SUMR(1,NSF,3)
C
        SUML(1,NSF,3)= -SUML(1,NSF,3)
        SUML(2,NSF,3)= -SUML(1,NSF,3)
        A04 7210    1887
        A04 7220    1888
        A04 7230    1889
        A04 7240    1890
        A04 7250    1891
        A04 7260    1892
        A04 7270    1893
        A04 7280    1894
        A04 7290    1895
        A04 7300    1896
        A04 7310    1897
        A04 7320    1898
        A04 7330    1899
        A04 7340    1900
        A04 7350    1901
        A04 7360    1902
        A04 7370    1903
        A04 7380    1904
        A04 7390    1905
        A04 7400    1906
        A04 7410    1907
        A04 7420    1908
        A04 7430    1909
        A04 7440    1910
        A04 7450    1911
        A04 7460    1912
        A04 7470    1913
        A04 7480    1914
        A04 7490    1915
        A04 7500    1916
        A04 7510    1917
        A04 7520    1918
        A04 7530    1919
        A04 7540    1920
        A04 7550    1921
        A04 7560    1922
        A04 7570    1923
        A04 7580    1924
        A04 7590    1925
        A04 7600    1926
        A04 7610    1927
        A04 7620    1928
        A04 7630    1929
        A04 7640    1930
        A04 7650    1931
        A04 7660    1932
        A04 7670    1933
        A04 7680    1934
        A04 7690    1935
        A04 7700    1936
        A04 7710    1937
        A04 7720    1938
        A04 7730    1939
        A04 7740    1940
        A04 7750    1941
        A04 7760    1942
        A04 7770    1943
        A04 7780    1944
        A04 7790    1945
        A04 7800    1946
        A04 7810    1947
        A04 7820    1948
        A04 7830    1949
        A04 7840    1950
        A04 7850    1951
        A04 7860    1952
        A04 7870    1953
        A04 7880    1954
        A04 7890    1955
        A04 7900    1956
        A04 7910    1957
        A04 7920    1958
        A04 7930    1959
        A04 7940    1960
        A04 7950    1961
        A04 7960    1962
        A04 7970    1963
        A04 7980    1964
        A04 7990    1965
        A04 8000    1966
        A04 8010    1967
        A04 8020    1968
        A04 8030    1969
        A04 8040    1970
        A04 8050    1971
        A04 8060    1972
        A04 8070    1973
        A04 8080    1974
        A04 8090    1975
        A04 8100    1976
        A04 8110    1977
        A04 8120    1978
        A04 8130    1979
        A04 8140    1980
        A04 8150    1981
        A04 8160    1982
        A04 8170    1983
        A04 8180    1984
        A04 8190    1985
        A04 8200    1986
        A04 8210    1987
        A04 8220    1988
        A04 8230    1989
        A04 8240    1990

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ZUMP(1,NSF,1) = ( ZUML(1,NSF,1)*COSA - ZUML(1,NSF,3)*SINA )      A04 8250    1991
ZUMR(1,NSF,2) = ZUML(1,NSF,2)                                         A04 8260    1992
ZUMR(1,NSF,3) = (-ZUML(1,NSF,3)*COSA - ZUML(1,NSF,1)*SINA )      A04 8270    1993
C
ZUMR(2,NSF,1) = ZUMR(1,NSF,1)                                         A04 8280    1994
ZUMP(2,NSF,2) = ZUMR(1,NSF,2)                                         A04 8290    1995
ZUMR(2,NSF,3) = ZUMR(1,NSF,3)                                         A04 8300    1996
C
ZUML(1,NSF,3)= -ZUML(1,NSF,3)                                         A04 8310    1997
ZUML(2,NSF,3)= -ZUML(1,NSF,3)                                         A04 8320    1998
C
2110 CONTINUE
C
C
DO 2130 N=NSURF1,NSURF2
C
DO 2120 L=1,3
ZUML(2,N,L) = ZUML(1,N,L)*FACN(1,1)                                     A04 8330    1999
ZUMR(2,N,L) = ZUMR(1,N,L)*FACN(1,1)                                       A04 8340    2000
ZUML(1,N,L) = ZUML(1,N,L)*FACN(N,1)                                       A04 8350    2001
ZUMR(1,N,L) = ZUMR(1,N,L)*FACN(N,1)                                       A04 8360    2002
A04 8370    2003
A04 8380    2004
A04 8390    2005
A04 8400    2006
A04 8410    2007
A04 8420    2008
A04 8430    2009
A04 8440    2010
A04 8450    2011
A04 8460    2012
A04 8470    2013
A04 8480    2014
A04 8490    2015
A04 8500    2016
A04 8510    2017
A04 8520    2018
A04 8530    2019
A04 8540    2020
A04 8550    2021
A04 8560    2022
A04 8570    2023
A04 8580    2024
A04 8590    2025
A04 8600    2026
A04 8610    2027
A04 8620    2028
A04 8630    2029
A04 8640    2030
A04 8650    2031
A04 8660    2032
A04 8670    2033
A04 8680    2034
A04 8690    2035
A04 8700    2036
A04 8710    2037
A04 8720    2038
A04 8730    2039
A04 8740    2040
A04 8750    2041
A04 8760    2042
A04 8770    2043
A04 8780    2044
A04 8790    2045
C
IF (EEXEC(15)-1.C) 2060,2100,2100
2060 IF (IFLG(201-21 2100,2070,2070
2070 LIN= LIN +2
IF (LINX-LIN) 2080,2090,2090
2080 CALL PAGE
GO TO 2100
2090 WRITE (KDUT,1000)
WR ITE (KDUT,1000)
2100 CONTINUE
C
C
SUMR(1,NSF,1) = ( SUML(1,NSF,1)*COSA - SUML(1,NSF,3)*SINA )      A04 8800    2046
SUMR(1,NSF,2) = SUML(1,NSF,2)                                         A04 8810    2047
SUMR(1,NSF,3) = (-SUML(1,NSF,3)*COSA - SUML(1,NSF,1)*SINA )      A04 8820    2048
C
SUMR(2,NSF,1) = SUMR(1,NSF,1)                                         A04 8830    2049
SUMR(2,NSF,2) = SUMR(1,NSF,2)                                         A04 8840    2050
SUMR(2,NSF,3) = SUMR(1,NSF,3)                                         A04 8850    2051
C
SUML(1,NSF,3)= -SUML(1,NSF,3)                                         A04 8860    2052
SUML(2,NSF,3)= -SUML(1,NSF,3)                                         A04 8870    2053
C
A04 8880    2054
A04 8890    2055
A04 8900    2056
A04 8910    2057
A04 8920    2058
A04 8930    2059
A04 8940    2060
A04 8950    2061
A04 8960    2062
A04 8970    2063
A04 8980    2064
A04 8990    2065
A04 9000    2066
A04 9010    2067
A04 9020    2068
A04 9030    2069
A04 9040    2070
A04 9050    2071
A04 9060    2072
A04 9070    2073
A04 9080    2074
A04 9090    2075
A04 9100    2076
A04 9110    2077
A04 9120    2078
A04 9130    2079
A04 9140    2080
A04 9150    2081
A04 9160    2082
A04 9170    2083
A04 9180    2084
A04 9190    2085
A04 9200    2086
A04 9210    2087
A04 9220    2088
A04 9230    2089
A04 9240    2090
A04 9250    2091
A04 9260    2092
A04 9270    2093
A04 9280    2094
A04 9290    2095
A04 9300    2096
C
ZUMP(1,N,L) = ZUMP(1,N,1)*FACN(N,2)
ZUMP(1,N,2) = ZUMP(1,N,2)*FACN(N,3)

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```

ZUMP(1,N,3) = ZUMP(1,N,1)*FACN(N,3)          A04 9310    2097
ZUMP(2,N,1) = ZUMP(2,N,1)*FACN(1,2)          A04 9320    2098
ZUMP(2,N,2) = ZUMP(2,N,2)*FACN(1,3)          A04 9330    2099
ZUMP(2,N,3) = ZUMP(2,N,3)*FACN(1,3)          A04 9340    2100
C
C     SUMP(1,N,1) = SUMP(1,N,1)*FACN(N,2)        A04 9350    2101
C     SUMP(1,N,2) = SUMP(1,N,2)*FACN(N,3)        A04 9360    2102
C     SUMP(1,N,3) = SUMP(1,N,3)*FACN(N,3)        A04 9370    2103
C     SUMP(2,N,1) = SUMP(2,N,1)*FACN(1,2)        A04 9380    2104
C     SUMP(2,N,2) = SUMP(2,N,2)*FACN(1,3)        A04 9390    2105
2130  SUMP(2,N,3) = SUMP(2,N,3)*FACN(1,3)        A04 9400    2106
C
C     DO 2150 N=2,NSURF2
C     DO 2140 L=1,3
C       ZUML(2,1,L) = ZUML(2,1,L) + ZUML(2,N,L)
C       ZUMR(2,1,L) = ZUMR(2,1,L) + ZUMR(2,N,L)
C       ZUMP(2,1,L) = ZUMP(2,1,L) + ZUMP(2,N,L)
C       SUML(2,1,L) = SUML(2,1,L) + SUML(2,N,L)
C       SUMR(2,1,L) = SUMR(2,1,L) + SUMR(2,N,L)
2140  SUMP(2,1,L) = SUMP(2,1,L) + SUMP(2,N,L)
2150  CONTINUE
C
C     DO 2160 L=1,3
C       ZUMLG(L)= ZUMLG(L)*FACNG(1)
2160  SUMLG(L)= SUMLG(L)*FACNG(1)
C       ZUMLG(3)= -ZUMLG(3)
C       SUMLG(3)= -SUMLG(3)
C
C       ZUMPG(1) = ZUMPG(1)*FACNG(2)
C       ZUMPG(2) = ZUMPG(2)*FACNG(3)
C       ZUMPG(3) = ZUMPG(3)*FACNG(3)
C
C       SUMPG(1) = SUMPG(1)*FACNG(2)
C       SUMPG(2) = SUMPG(2)*FACNG(3)
C       SUMPG(3) = SUMPG(3)*FACNG(3)
C
C       ZACNG(2) = ZUMLG(1)*COSA + ZUMLG(3)*SINA
C       ZACNG(3) = ZUMLG(2)
C       ZACNG(1) = ZUMLG(3)*COSA - ZUMLG(1)*SINA
C
C       FACNG(2) = SUMLG(1)*COSA + SUMLG(3)*SINA
C       FACNG(3) = SUMLG(2)
C       FACNG(1) = SUMLG(3)*COSA - SUMLG(1)*SINA
C
C
C ** LIFTING SURFACES AIRLOAD SECTION COEFFICIENTS **
C
C     DO 2360 NSF=NSURF1,NSURF2
C
C       NM = 0
C       J1 = JN1(NSF)
C       J2 = JN2(NSF)
C       K2 = KN2(NSF)
C       NZERO = JNO(NSF)
C       NOO = NSSO(NSF)
C
C       SYMGF2 = SYMGF(NSF) -1.0
C       SYMGF3 = -SYMGF(NSF) +2.0
C       SPAN = WINGD(NSF,1)
C
C       DO 2330 J=NZERO,J2
C       IF (JSINGPINNSF).EQ.J1 GO TO 2330
C
C       JP1= J +1
C       NM = NM +1
C       W1 = EW(J,1)
C       W2 = EW(JP1,1)
C       WA = EW(NO0)
C       WR = 2.0*( W1-WA )
C       TEST = ABS( W1 - W2 ) - 0.001
C       IF (TEST) 2180,2180,2170
2170  WA = (W1+W2)/2.0
C       WB = ABS( W1-W2 )
2180  CONTINUE
C       RW = WA
C
C       CALL CORDF(W1,Y1,XL1,XT1,ZL1,EP1,CW1,CF1,CB1,TAD1,TAS1,RATS,M1,M2)A0410090
C       CALL CORDF(W2,Y2,XL2,XT2,ZL2,EP2,CW2,CF2,CB2,TAD2,TAS2,RATS,M1,M2)A0410100
C       CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TASD,RATS,M1,M2)A0410110
C
C       TANL = (ELE(M2)-ELE(M1))/WB          A0410120
C       FOSLE = SQR(1.0 + TANL**2)           A0410130
C       XHE = 0.5*( XT1+XT2 -CF1-CF2 )      A0410140
C       XHEE = 0.5*( XT1+XT2 -CB1-CB2 )      A0410150
C       COSD = 1.0/SQR( 1.0 + TANL**2 )      A0410160
C       SIND= 1.0                            A0410170
C       IF(TAND.LT.0) SIND= -1.0            A0410180
C       IF(COSD.GT.0.00001) SIND= TAND*COSD A0410190
C       CW = 0.5*( CW1+CW2 )                A0410200
C       AREA= WB*( COSD*SYMGF2 + SIND*SYMGF3 ) A0410210
C       IF(AREA.LT.1.0E-6) AREA=WB*CW*( COSD*SYMGF3 + SIND*SYMGF2 ) A0410220
C       XC04 = 0.5*(XL1+XL2) + 0.25*CW      A0410230
C
C       SCN = 0.0                            A0410240
C       SCX = 0.0                            A0410250
C       SPM = 0.0                            A0410260
C       SCL = 0.0                            A0410270
C       SCD = 0.0                            A0410280
C
C       DO 2250 K=1,K2
C
C       COSI(1)= VVINDX(j,K,1) + COSA      A0410290
C       COSI(2)= VVINDX(j,K,2)              A0410300

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```

      COSI(3)= VVINDEX(J,K,3) - SIN4          A0410370    2203
C      DO 2190 L=1,3                         A0410380    2204
      LP3=L+3                                A0410390    2205
      BIL1= EV(J,K,L)                         A0410400    2206
  2190 DIL1= EV(JL1,K,L)                     A0410410    2207
C      SH1 = B(21)                           A0410420    2208
C      CALL FLAPS(NSF,W1,SH1,XT1,CF1,CB1,TAD1,    B,COS3) A0410430    2209
      CALL FLAPS(NSF,W2,SH2,XT2,CF2,CB2,TAD2,    D,COS3) A0410440    2210
C      SUM8 = 0.0                            A0410450    2211
      DO 2200 L=1,3                         A0410460    2212
      P(L)= 0.5*( B(L) + D(L) )             A0410470    2213
      COS2(L)= D(L)-B(L)                   A0410480    2214
  2200 SUM8= SUM8 + COS2(L)**2            A0410490    2215
      SUM8 = SQRT(SUM8)                    A0410500    2216
      DO 2210 L=1,3                         A0410510    2217
      COS2(L)= COS2(L)/SUM8                A0410520    2218
C      CALL CROSP(COS1,COS2,COS3)           A0410530    2219
C      SLIFT= EG(J,K)*SUM8                 A0410540    2220
C      DO 2220 L=1,3                         A0410550    2221
      SUMSL(L)= SLIFT*COS3(L)              A0410560    2222
C      CALL CROSP(COS1,COS2,COS3)           A0410570    2223
C      SLIFT= EG(J,K)*SUM8                 A0410580    2224
C      DO 2230 L=1,3                         A0410590    2225
      SUMSL(L)= SLIFT*COS3(L)              A0410600    2226
C      DCN = -SUMSL(1)*SYMGF2 + SUMSL(1)*SYMGF3 A0410610    2227
C      SCN = SCN + DCN                    A0410620    2228
      SCX = SCX + SUMSL(1)                  A0410630    2229
      SPM = SPM - DCN*(P(1)-XC04)/CW       A0410640    2230
C      SUM8 = 0.0                          A0410650    2231
      DO 2230 L=1,3                         A0410660    2232
      SUMSL(L)= SUMSL(L)/SUMSL(1)          A0410670    2233
C      DCN = -SUMSL(1)*SYMGF2 + SUMSL(1)*SYMGF3 A0410680    2234
C      SCN = SCN + DCN                    A0410690    2235
      SCX = SCX + SUMSL(1)                  A0410700    2236
      SPM = SPM - DCN*(P(1)-XC04)/CW       A0410710    2237
C      SUM8 = 0.0                          A0410720    2238
      DO 2240 L=1,3                         A0410730    2239
      SUMSL(L)= SUMSL(L)/SUMSL(1)          A0410740    2240
C      SUM8 = 0.0                          A0410750    2241
      DO 2230 L=1,3                         A0410760    2242
      SUM8= SUM8 + SUMSL(L)**2            A0410770    2243
      SUMSL(4)= SQRT(SUM8)                A0410780    2244
      DO 2240 L=1,3                         A0410790    2245
      SUMSL(L)= SUMSL(L)/SUMSL(4)          A0410800    2246
C      2250 CONTINUE                      A0410810    2247
C      SCN= SCN*(2.0/AREA)                A0410820    2248
      SCX= SCX*(2.0/AREA)                A0410830    2249
      SPM= SPM*(2.0/AREA)                A0410840    2250
C      A0410850    2251
      SCL= SYMGF2*(SCN*COSA-SCX*SINA)+SYMGF3*(SCN1 A0410860    2252
      SCD= SYMGF2*(SCX*SINA+SCN*SINA)+SYMGF3*(SCX*COSA) A0410870    2253
C      A0410880    2254
      SCLCOB= SCL+CW/SPAN                A0410890    2255
C      RY = EN(J,1,2)                      A0410900    2256
      RZ = EN(J,1,3)                      A0410910    2257
C      A0410920    2258
      A0410930    2259
      A0410940    2260
      RY = EN(J,1,2)                      A0410950    2261
      RZ = EN(J,1,3)                      A0410960    2262
C      A0410970    2263
      A0410980    2264
      IF (NM-1) 2260,2260,2310          A0410990    2265
  2260 LIN= LIN +4                      A0411000    2266
      IF (LINK-LIN) 2270,2280,2280          A0411010    2267
  2270 CALL PAGE                        A0411020    2268
      LIN= LIN +4                      A0411030    2269
  2280 WRITE (KOUT,1080)ASF,NSURF1,NSURF2 A0411040    2270
      LIN= LIN +2                      A0411050    2271
      IF (LINK-LIN) 2290,2300,2300          A0411060    2272
  2290 CALL PAGE                        A0411070    2273
      LIN= LIN +2                      A0411080    2274
  2300 WRITE (KOUT,1090)                A0411090    2275
  2310 LIN= LIN+1                      A0411100    2276
      IF (LINK-LIN) 2290,2320,2320          A0411110    2277
  2320 Y1B= ( EN(J,1,2)*SYMGF2 + (EN(J,2,1,3)-EN(J,1,3))*SYMGF3 )/SPAN A0411120    2278
C      A0411130    2279
C      A0411140    2280
      WRITE (KOUT,1100)J,Y0B,RY,RZ,RW,SCN,SCX,SCL,SCD,SPM,SCLCOB,(SUMSL(1) A0411150    2281
      LIN,I=1,L,3)                      A0411160    2282
      LIN= LIN +1                      A0411170    2283
C      A0411180    2284
      A0411190    2285
C      2330 CONTINUE                      A0411200    2286
      LIN= LIN +2                      A0411210    2287
      IF (LINK-LIN) 2340,2350,2350          A0411220    2288
  2340 CALL PAGE                        A0411230    2289
      GO TO 2360                      A0411240    2290
  2350 WRITE (KOUT,1000)                A0411250    2291
      WRITE (KOUT,1000)                A0411260    2292
  2360 CONTINUE                      A0411270    2293
C      A0411280    2294
C      A0411290    2295
C      A0411300    2296
C      ** LIFTING SURFACES AIRLOAD SUMMARY ***
C      LIN = LIN + 12                  A0411310    2297
C      A0411320    2298
      A0411330    2299
      A0411340    2300
      A0411350    2301
  2370 CALL PAGE                        A0411360    2302
      LIN = LIN + 12                  A0411370    2303
  2380 WRITE (KOUT,1110)NSURF1,NSURF2 A0411380    2304
C      A0411390    2305
      A0411400    2306
      A0411410    2307
C      DD 2410 N=1,NSURF2              A0411420    2308

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        LIN = LIN + 2                                A0411430    2309
        IF (LINX-LIN) 2390,2400,2400
2390 CALL PAGE
        LIN = LIN + 12
        WRITE (KOUT,1110)NSURF1,NSURF2
2400 CONTINUE
C
        WRITE (KOUT,1120)N,SUML(1,N,3),SUML(1,N,1),SUML(1,N,2),SUMR(1,N,3)A0411500 2316
        1,SUMR(1,N,1),(SUMP(1,N,I),I=1,3),WINGD(N,11),WINGD(N,12),WINGD(N,6)A0411510 2317
        2),WINGD(N,9),WINGD(N,1)
C
        WRITE (KOUT,1160)N,ZUML(1,N,3),ZUML(1,N,1),ZUML(1,N,2),ZUMR(1,N,3)A0411540 2320
        1,ZUMR(1,N,1),(ZUMP(1,N,I),I=1,3),WINGD(N,11),WINGD(N,12),WINGD(N,6)A0411550 2321
        2),WINGD(N,9),WINGD(N,1)
C
        A0411530    2319
C
        A0411560    2322
C
        A0411570    2323
C
        A0411580    2324
C
        A0411590    2325
C
        LIN = LIN + 11
        IF (LINX-LIN) 2420,2430,2430
2420 CALL PAGE
        LIN = LIN + 11
2430 CONTINUE
C
        WRITE (KOUT,1130)SUML(2,1,3),SUML(2,1,1),SUML(2,1,2),SUMR(2,1,3),SA0411660 2332
        1UMR(2,1,1),(SUMP(2,1,I),I=1,3),WINGD(1,11),WINGD(1,12),WINGD(1,6),A0411670 2333
        2WINGD(1,9),WINGD(1,1),SUMLG(3),(SUMLG(I),I=1,2),(FACNG(I),I=1,2),A0411680 2334
        3SUMPG(I),I=1,3),XCG,CG,REFS,REFC,REFB,ZUML(2,1,3),ZUML(2,1,1),ZUMA0411690 2335
        4L(2,1,2),ZUMR(2,1,3),ZUMA(2,1,1),(ZUMP(2,1,I),I=1,3),WINGD(1,11),WINGD(1,12),A0411700 2336
        5NGD(1,12),WINGD(1,6),WINGD(1,9),WINGD(1,11),ZUMLG(3),(ZUMG(GI),I=1A0411710 2337
        6,2),(ZACNG(I),I=1,2),(ZUMPG(I),I=1,3),XCG,CG,REFS,REFC,REFB,DETERA0411720 2338
        7H,SCALE
        A0411730    2339
C
        A0411740    2340
C
        A0411750    2341
C
        A0411760    2342
C
        A0411770    2343
C
        END          2344

```

```

      FOR A05,A05          A05   10    2345
C
C
      SUBROUTINE ABORTJ(NODO,TEST,TEST)          A05   20    2346
C
      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *A05   60    2347
C
      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *A05   70    2348
C
      A05   80    2349
C
      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXA05   90    2350
C
      A05   100   2351
C
      A05   110   2352
C
      COMMON/DATA01/ KIN, KOUT, KT1, KT2, KT3, KREC, KFILE, LIM, LINK
      1 ,RAD, PIE, CUTOFL, CUTOF2, DELALF, LFLAP, LDRAG, COLOC
      2 ,IFLG(20), EXECK(15)          A05   120   2353
C
      EQUIVALENCE (D,N)
C
      DATA CHAK/0.90/
      DATA I5/5/,T10/10/,T10D/100/,I60/60/,I25/30/
C
      A05   130   2354
C
      A05   140   2355
C
      A05   150   2356
C
      A05   160   2357
C
      A05   170   2358
C
      A05   180   2359
C
      A05   190   2360
C
      A05   200   2361
C
      A05   210   2362
C
      A05   220   2363
C
      A05   230   2364
C
      A05   240   2365
C
      A05   250   2366
C
      A05   260   2367
C
      A05   270   2368
C
      A05   280   2369
C
      A05   290   2370
C
      A05   300   2371
C
      A05   310   2372
C
      A05   320   2373
C
      A05   330   2374
C
      A05   340   2375
C
      A05   350   2376
C
      A05   360   2377
C
      A05   370   2378
C
      A05   380   2379
C
      A05   390   2380
C
      A05   400   2381
C
      A05   410   2382
C
      A05   420   2383
C
      A05   430   2384
C
      A05   440   2385
C
      A05   450   2386
C
      A05   460   2387
C
      A05   470   2388
C
      A05   480   2389
C
      A05   490   2390
C
      A05   500   2391
C
      A05   510   2392
C
      A05   520   2393
C
      A05   530   2394
C
      A05   540   2395
C
      A05   550   2396
C
      A05   560   2397
C
      A05   570   2398
C
      A05   580   2399
C
      A05   590   2400
C
      A05   600   2401
C
      A05   610   2402
C
      A05   620   2403
C
      A05   630   2404
C
      A05   640   2405
C
      A05   650   2406
C
      A05   660   2407
C
      A05   670   2408
C
      A05   680   2409
C
      A05   690   2410
C
      A05   700   2411

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      RETURN
1130 IF (I100.LT.ITEST) WRITE (KOUT,1030) ITEST
     IF(I100.LT.ITEST) CALL EXIT
     RETURN
1140 IF (CMAK.LT.TEST) WRITE (KOUT,1040) TEST
     IF(CMAK.LT.TEST) CALL EXIT
     RETURN
1150 IF (I25.LT.ITEST) WRITE (KOUT,1050) ITEST
     IF(I25.LT.TEST) CALL EXIT
     RETURN
1160 IF (I10.LT.ITEST) WRITE (KOUT,1060) ITEST
     IF(I10.LT.TEST) CALL EXIT
     RETURN
1170 IF (ITEST.LT.0) WRITE (KOUT,1070) ITEST
     IF(ITEST.LT.0) CALL EXIT
     RETURN
1180 IF (ITEST.LT.0) WRITE (KOUT,1080) ITEST
     IF(ITEST.LT.0) CALL EXIT
     RETURN
1190 D= TEST
     IF (N.LE.1TFST) WRITE (KOUT,1090) N,TEST
     IF(N.LE.ITEST) CALL EXIT
     RETURN
C
C      END
          A05   680    2412
          A05   690    2413
          A05   700    2414
          A05   710    2415
          A05   720    2416
          A05   730    2417
          A05   740    2418
          A05   750    2419
          A05   760    2420
          A05   770    2421
          A05   780    2422
          A05   790    2423
          A05   800    2424
          A05   810    2425
          A05   820    2426
          A05   830    2427
          A05   840    2428
          A05   850    2429
          A05   860    2430
          A05   870    2431
          A05   880    2432
          A05   890    2433
          A05   900    2434
          A05   910    2435
          A05   920    2436

V FOR A06,A06
C
C      SUBROUTINE CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTB,TAND,TANS,R,M1,M) A06   10    2437
C
C      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *A06   20    2438
C      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *A06   30    2439
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A06   40    2440
C
C      COMMON/DATA02/ NINC, NFUS, NVTAIL, NSS(5), NSS0(5), NCS(5)
C      1 ,X30), Y(30), Z(30), E130), C130), KOCR(30), FLAPC(30), TABC(30) A06   50    2441
C      2 ,WSMOTH, EWE(30), ELE(30), ETE(30), EHE(30), EHEE(30) A06   60    2442
C      3 ,XOC(10,5), ZOC(10,30) A06   70    2443
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A06   80    2444
C
C      COMMON/DATA02/ NINC, NFUS, NVTAIL, NSS(5), NSS0(5), NCS(5)
C      1 ,X30), Y(30), Z(30), E130), C130), KOCR(30), FLAPC(30), TABC(30) A06   90    2445
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A06   100   2446
C
C      COMMON/DATA02/ NINC, NFUS, NVTAIL, NSS(5), NSS0(5), NCS(5)
C      1 ,X30), Y(30), Z(30), E130), C130), KOCR(30), FLAPC(30), TABC(30) A06   110   2447
C      2 ,WSMOTH, EWE(30), ELE(30), ETE(30), EHE(30), EHEE(30) A06   120   2448
C      3 ,XOC(10,5), ZOC(10,30) A06   130   2449
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A06   140   2450
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A06   150   2451
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A06   160   2452
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A06   170   2453
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A06   180   2454
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A06   190   2455
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A06   200   2456
C
C      M=-1
C      NX= 30
C      DO 1020 L=2,NX
C      IF (M) 1000,1000,1020
1000 TEST= WA - EWE(M) - 0.001
     IF (TEST) 1010,1010,1020
1010 M=L
1020 CONTINUE
C
C      IF (M-2) 1030,1040,1040
1030 M=2
1040 M1= M-1
C
C      RATS=(WA-EWE(M1))/(EWE(M)-EWE(M1))
C
C      XLE = ELE(M1) + RATS*( ELE(M) - ELE(M1) )
C      XTE = ETE(M1) + RATS*( ETE(M) - ETE(M1) )
C      XHE = EHE(M1) + RATS*( EHE(M) - EHE(M1) )
C      XHEE= EHEE(M1)+ RATS*( EHEE(M) - EHEE(M1) )
C      EPS = E(M1) + RATS*( E(M)-E(M1) )
C      ZLE = Z(M1) + RATS*( Z(M)-Z(M1) )
C      CW = XTE - XLE
C      CF = XTE - XHE
C      CTB= XTE - XHEE
C      R = RATS
C
C      DY = Y(N)-Y(M)
C      DW = EWE(M)-EWE(M1)
C      YA = Y(M) + RATS*DY
C      TANC = 100000.0
C      TEST= ABS(DY) - 0.001
C
C      IF (TEST) 1060,1060,1050
1050 TANO= (Z(M1)-Z(N))/DY
1060 TANS= (X(M)*C(M)*(0.25-XOCR(M))-X(M1)-C(M1)*(0.25-XOCR(M1)))/DW
C
C      RETURN
C      XXXXXX
C
C      END
          A06   210   2457
          A06   220   2458
          A06   230   2459
          A06   240   2460
          A06   250   2461
          A06   260   2462
          A06   270   2463
          A06   280   2464
          A06   290   2465
          A06   300   2466
          A06   310   2467
          A06   320   2468
          A06   330   2469
          A06   340   2470
          A06   350   2471
          A06   360   2472
          A06   370   2473
          A06   380   2474
          A06   390   2475
          A06   400   2476
          A06   410   2477
          A06   420   2478
          A06   430   2479
          A06   440   2480
          A06   450   2481
          A06   460   2482
          A06   470   2483
          A06   480   2484
          A06   490   2485
          A06   500   2486
          A06   510   2487
          A06   520   2488
          A06   530   2489
          A06   540   2490
          A06   550   2491
          A06   560   2492
          A06   570   2493
          A06   580   2494
          A06   590   2495
          A06   600   2496

V FOR A07,A07
C
C      SUBROUTINE CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,XF,ZF) A07   10    2497
C
C      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *A07   20    2498
C      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *A07   30    2499
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A07   40    2500
C
C      DIMENSION ZOCY(10)
C
C      COMMON/DATA01/ KIN, KOUT, KT1, KT2, KT3, KREC, KFILE, LIN, LINK
C      1 ,RAD, PIE, CUTOF1, CUTOF2, DELALF, LFLAP, LORAG, COLOC
C      2 ,IFLG(20), EXECK(15) A07   50    2501
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A07   60    2502
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A07   70    2503
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A07   80    2504
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A07   90    2505
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A07   100   2506
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A07   110   2507
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A07   120   2508
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A07   130   2509
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A07   140   2510
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A07   150   2511

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C COMMON/DATA02/ NWING, NFUS, NVTAIL, NSS(5), NSSO(5), NCS(5)
1 ,X(30), Y(30), Z(30), E(30), C(30), XOCR(30), FLAPC(30), TABC(30) A07 160 2512
2 ,NSMOTH, EWE(30), ELE(30), ETE(30), EHEE(30) A07 170 2513
3 ,ZOC(10,5), ZOC(10,30) A07 180 2514
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A07 190 2515
C A07 200 2516
C A07 210 2517
C IF(CW.LE.1.OE-4) RETURN A07 220 2518
DO 1000 L=1,NK A07 230 2519
1000 ZOCY(L)= ZOC(L,M1) + RAT*(ZOC(L,M2)-ZOC(L,M1)) A07 240 2520
C XOCREF = XOCR(M1) + RAT*(XOCR(M2)-XOCR(M1)) A07 250 2521
TANE = TAN(EPS/RAD) A07 260 2522
XOCT = (XF-XLE)/CW A07 270 2523
C IF(CW.LE.1.OE-4) RETURN A07 280 2524
DO 1000 L=1,NK A07 290 2525
1000 ZOCY(L)= ZOC(L,M1) + RAT*(ZOC(L,M2)-ZOC(L,M1)) A07 300 2526
C XOCREF = XOCR(M1) + RAT*(XOCR(M2)-XOCR(M1)) A07 310 2527
TANE = TAN(EPS/RAD) A07 320 2528
XOCT = (XF-XLE)/CW A07 330 2529
C N2 = -1 A07 340 2530
DO 1030 L=2,NK A07 350 2531
IF (N2) 1010,1010,1030 A07 360 2532
1010 TEST = XOCT - XOC(L,NSF) - 0.001 A07 370 2533
IF (TEST) 1020,1020,1030 A07 380 2534
1020 N2=L A07 390 2535
1030 CONTINUE A07 400 2536
IF (N2-1) 1040,1040,1050 A07 410 2537
1040 N2= 2 A07 420 2538
1050 N1= N2-1 A07 430 2539
C RAT = (XOCT - XOC(N1,NSF))/(XOC(N2,NSF)-XOC(N1,NSF)) A07 440 2540
DELZ= CW*( ZOCY(N1) + RAT*( ZOCY(N2)-ZOCY(N1) ) ) A07 450 2541
C ZF = ZF + DELZ + TANE*( XF - XLE - CW*XOCREF ) A07 460 2542
A07 470 2543
RETURN A07 480 2544
C END A07 490 2545
A07 500 2546
A07 510 2547
A07 520 2548
A07 530 2549

D FOR A08,A08
C
C SUBROUTINE FLAPS(NSF,WA,SHEK,XTE,CF,CTAB,TAND, P,COSN)
C * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *A08 60 2555
C * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *A08 70 2556
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A08 80 2557
C A08 90 2558
C A08 100 2559
REAL NOAIL,NOGO A08 110 2560
DIMENSION P(3), COSN(3)
C
C COMMON/DATA01/ KIN, KOUT, KT1, KT2, KT3, KREC, KFILE, LIN, LINK
1 ,RAD, PIE, CUTOF1, CUTOF2, DELALF, LFLAP, LORAG, COLOC P A08 150 2564
2 ,IFLG(20), EXEC(15) A08 160 2565
A08 170 2566
A08 180 2567
C COMMON/DATA02/ NWING, NFUS, NVTAIL, NSS(5), NSSO(5), NCS(5)
1 ,X(30), Y(30), Z(30), E(30), C(30), XOCR(30), FLAPC(30), TABC(30) A08 190 2568
2 ,NSMOTH, EWE(30), ELE(30), ETE(30), EHEE(30) A08 200 2569
3 ,ZOC(10,5), ZOC(10,30) A08 210 2570
A08 220 2571
A08 230 2572
C COMMON/DATA03/FLAPDJ(5),TABDJ(5),A1LDJ(2,5),DELTFL1(5),DELTFL2(5)
1 ,WFF1(5), WFF12(5), WFF21(5), WFF22(5), WFF31(5) A08 240 2573
2 ,WFLAP1(5), WFLAP2(5), WFLAP3(5) A08 250 2574
A08 260 2575
A08 270 2576
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A08 280 2577
C A08 290 2578
C A08 300 2579
C A08 310 2580
C A08 320 2581
C A08 330 2582
C A08 340 2583
C A08 350 2584
C A08 360 2585
A08 370 2586
A08 380 2587
C IF (NOFLAP) 1310,1310,1000 A08 390 2588
1000 XFLAP = P(1) - { XTE - CF }
XTAB = P(1) - { XTE - CTAB }
IF (XFLAP) 1310,1310,1010 A08 400 2589
1010 CONTINUE A08 410 2590
A08 420 2591
A08 430 2592
A08 440 2593
A08 450 2594
A08 460 2595
SINC = TAND*COSD A08 470 2596
A08 480 2597
A08 490 2598
A08 500 2599
A08 510 2600
A08 520 2601
A08 530 2602
A08 540 2603
A08 550 2604
A08 560 2605
A08 570 2606
A08 580 2607
A08 590 2608
A08 600 2609
A08 610 2610
A08 620 2611
A08 630 2612
A08 640 2613
A08 650 2614

DFLAP= 0.0
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      DA1LD= 0.0          A08  660    2615
      DTAB = 0.0          A08  670    2616
C      NO = NSSO(NI)     A08  680    2617
      YA = WA - EWE(NO) A08  690    2618
      WFF32 = WFF31(N) + WFF22(N)-WFF21(N) A08  700    2619
C      TST11 = YA - WFF11(N)     A08  710    2620
      TST12 = YA - WFF12(N)     A08  720    2621
      TST21 = YA - WFF21(N)     A08  730    2622
      TST22 = YA - WFF22(N)     A08  740    2623
      TST31 = YA - WFF31(N)     A08  750    2624
      TST32 = YA - WFF32     A08  760    2625
C      C
      IF (NOFLAPI) 1120,1120,1040     A08  770    2626
1040 IF (WFLAPI(N)) 1080,1080,1050     A08  780    2627
1050 IF (TST11) 1120,1120,1060     A08  790    2628
1060 IF (TST12) 1070,1080,1080     A08  800    2629
1070 SMF = 0.5*( 1.0 + SIN( PI* (TST11/DELTFL(N) -0.5) ) ) A08  810    2630
      DFLAP = SMF*FLAPO
      DTAB = SMF*TABD
      GO TO 1120
1080 IF (TST21) 1090,1090,1100     A08  820    2631
1090 SMF = 1.0
      DFLAP = SMF*FLAPO
      DTAB = SMF*TABD
      GO TO 1120
1100 IF (TST22) 1110,1120,1120     A08  830    2632
1110 SMF = 0.5*( 1.0 + SIN( PI* (TST21/DELTFL(N) +0.5) ) ) A08  840    2633
      DFLAP = SMF*FLAPO
      DTAB = SMF*TABD
      GO TO 1120
C      C
1120 IF (NOAIL1) 1210,1210,1130     A08  850    2634
1130 SMF = 1.0
      DA1LD = SMF*A1LD
1140 IF (TST21) 1150,1150,1160     A08  860    2635
1150 SMF = 0.0
      DA1LD = SMF*A1LD
      GO TO 1210
1160 IF (TST22) 1170,1180,1180     A08  870    2636
1170 SMF = 0.5*( 1.0 + SIN( PI* (TST21/DELTFL(N) -0.5) ) ) A08  880    2637
      DA1LD = SMF*A1LD
      GO TO 1210
1180 IF (TST31) 1210,1190,1190     A08  890    2638
1190 IF (TST32) 1200,1150,1150     A08  900    2639
1200 SMF = 0.5*( 1.0 + SIN( PI* (TST31/DELTFL(N) +0.5) ) ) A08  910    2640
      DA1LD = SMF*A1LD
      GO TO 1210
C      C
1210 CONTINUE
C      C
      IF (XTAB1) 1260,1220,1220     A08  920    2641
1220 NOGO = ABS( DTAB1 -0.1
      IF (NOGO) 1260,1230,1230     A08  930    2642
1230 TANF = TAN( DTAB/RAD 1
      COSF = 1.0/SQRT(1.0+TANF**2)
      SINF = TANF*COSF
      DNOR = XTAB*SINF
C      XCOS = COSX*COSF - COSZ*SINF
      ZCOS = COSZ*COSF + COSX*SINF
C      COSX = XCOS
      COSZ = ZCOS
C      IF (LFLAPI) 1240,1240,1250
1240 P(1) = P(1) - XTAB*(1.0-COSF)
      P(2) = P(2) + DNOR*SIND
      P(3) = P(3) + DNCR*COSD
1250 CONTINUE
C      C
1260 NOGO = ABS( DFLAP + DA1LD) - 0.1
      IF (NOGO) 1300,1300,1270
1270 TANF = TAN( (DFLAP + DA1LD )/RAD )
      COSF = 1.0/SQRT(1.0+TANF**2)
      SINF = TANF*COSF
      DNOR = XFLAP*SINF
C      XCOS = COSX*COSF - COSZ*SINF
      ZCOS = COSZ*COSF + COSX*SINF
C      COSX = XCOS
      COSZ = ZCOS
C      IF (LFLAPI) 1280,1280,1290
1280 P(1) = P(1) - XFLAP*(1.0-COSF)
      P(2) = P(2) + DNOR*SIND
      P(3) = P(3) + DNCR*COSD
1290 CONTINUE
C      C
1300 CONTINUE
C      COSN(1) = COSX
      COSN(2) = COSY*COSD + COSZ*SIND
      COSN(3) = COSZ*COSD - COSY*SIND
C      C
1310 RETURN
C      END

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    V FOR A09,A09          A09  10   2719
C
C
C      SUBROUTINE FLAPINSF(WA,SHE,XTE,CF,CTAB,TAND,XLE,YLE,ZLE,COS3) A09  20   2720
C
C      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *A09  30   2721
C      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *A09  40   2722
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXA09  50   2723
C
C      DIMENSION P(3),CCS3(3)          A09  60   2724
C
C      P(1)= XLE          A09  70   2725
C      P(2)= YLE          A09  80   2726
C      P(3)= ZLE          A09  90   2727
C
C      CALL FLAPS(NSP,WA,SHE,XTE,CF,CTAB,TAND, P,COS3)          A09 100   2728
C
C      XLE = P(1)          A09 110   2729
C      YLE = P(2)          A09 120   2730
C      ZLE = P(3)          A09 130   2731
C
C      RETURN             A09 140   2732
C
C      END                A09 150   2733
C
C      A09 160   2734
C      A09 170   2735
C      A09 180   2736
C
C      A09 190   2737
C      A09 200   2738
C      A09 210   2739
C      A09 220   2740
C      A09 230   2741
C      A09 240   2742
C      A09 250   2743
C
C      A09 260   2744
C      A09 270   2745
C      A09 280   2746

    V FOR A10,A10          A10  10   2747
C
C
C      SUBROUTINE REFLEC(P,ZL,ALFAR,COSR)          A10  20   2748
C
C      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *A10  30   2749
C      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *A10  40   2750
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXA10  50   2751
C
C      DIMENSION P(3)          A10  60   2752
C
C      COMMON/DATA01/ KTN, KOUT, KT1, KT2, KT3, KREC, KFILE, LIN, LINK
C      I ,RAD, PIE, CUTOF1, CUTOF2, DELALF, LFLAP, LDRAG, COLOC
C      1 ,IFLG(20), EXCK(15)          A10  70   2753
C
C      A10  80   2754
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXA10  90   2755
C
C      A10 100   2756
C
C      A10 110   2757
C
C      A10 120   2758
C
C      A10 130   2759
C
C      A10 140   2760
C
C      A10 150   2761
C
C      A10 160   2762
C
C      A10 170   2763
C
C      A10 180   2764
C
C      A10 190   2765
C
C      A10 200   2766
C
C      XXXXXXXXXXXXXXXXX)XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXA10 210   2767
C
C
C      A10 220   2768
C
C      A10 230   2769
C
C      A10 240   2770
C
C      A10 250   2771
C
C      A10 260   2772
C
C      A10 270   2773
C
C      A10 280   2774
C
C      A10 290   2775
C
C      A10 300   2776
C
C      A10 310   2777
C
C      A10 320   2778
C
C      A10 330   2779
C
C      A10 340   2780
C
C      A10 350   2781
C
C      A10 360   2782
C
C      A10 370   2783
C
C      A10 380   2784
C
C      A10 390   2785
C
C      A10 400   2786
C
C      A10 410   2787
C
C      A10 420   2788
C
C      A10 430   2789
C
C      A10 440   2790
C
C      A10 450   2791
C
C      A10 460   2792
C
C      A10 470   2793
C
C      A10 480   2794
C
C      A10 490   2795
C
C      A10 500   2796
C
C      A10 510   2797
C
C      A10 520   2798
C
C      A10 530   2799

    V FOR A11,A11          A11  10   2800
C
C
C      SUBROUTINE ISOMET(XLE,YLE,ZLE,REFL,XZER,YZER,ZZER)          A11  20   2801
C
C
C      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *A11  30   2802
C      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *A11  40   2803
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXA11  50   2804
C
C
C      RAD= 57.29578          A11  60   2805
C
C      PHIR= 45.0/RAD          A11  70   2806
C
C      PHIP = -PHIR          A11  80   2807
C
C      PHIQ = 0.5*PHIP          A11  90   2808
C
C      ZERO = 0.0          A11 100   2809
C
C      XLE= (XLE-XZER)/REFL          A11 110   2810
C
C      YLE= (YLE-YZER)/REFL          A11 120   2811
C
C      ZLE= (ZZER-ZLE)/REFL          A11 130   2812
C
C      A11 140   2813
C
C      A11 150   2814
C
C      A11 160   2815
C
C      A11 170   2816
C
C      A11 180   2817
C
C      A11 190   2818

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CALL ROTATE( XLE,ZLE, ZERC,ZERO, PHIP, ZERO,ZERO, XLE,ZLE ) A11 200 2819
CALL ROTATE( YLE,XLF, ZERO,ZERO, PHIP, ZERO,ZERO, YLE,XLE ) A11 210 2820
CALL ROTATE( YLE,ZLE, ZERC,ZERO, PHIQ, ZERO,ZERO, YLE,ZLE ) A11 220 2821
C RETURN A11 230 2822
C XXXXXX A11 240 2823
C END A11 250 2824
C A11 260 2825
C A11 270 2826

V FOR A12,A12
C A12 10 2827
C A12 20 2828
C A12 30 2829
C SUBROUTINE ROTATE( X,Y, XD,YD, PHI, XF,YF, XT,YT ) A12 40 2830
C A12 50 2831
C * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *A12 60 2832
C * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *A12 70 2833
C C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A12 80 2834
C C A12 90 2835
C KS = X-XD
C YS = Y-YD
C RHO= SQRT( KS**2 + YS**2 )
C ERROR= 0.0001
C TESTX= ABS(XS)-ERROR
C TESTY= ABS(YS)-ERROR
C IF (TESTX>1000,LGOD,1030
1000 IF (TESTY>1000,LGOD,1010,1020
1010 ZET= 0.0
GO TO 1110
1020 ZET= 1.570798*(YS/ABS(YS))- XS/YS
GO TO 1110
1030 ZET= ABS(YS/XS)
IF (TESTY>1050,1C50,1040
1040 ZET=ATAN(ZET)
1050 CONTINUE
IF (KS>1070,1060,1060
1060 IF (YS>1100,1110,1110
1070 IF (YS>1090,1080,1080
1080 ZET= 3.14159 - ZET
GO TO 1110
1090 ZET= 3.14159 + ZET
GO TO 1110
1100 ZET= 6.28318 - ZET
1110 CONTINUE
ZPP= PHI + ZET
XR = RHO*COS(ZPP)
YR = RHO*SIN(ZPP)
XT= XF + XR
YT= YF + YR
C RETURN
C XXXXXX
C END
A12 100 2836
A12 110 2837
A12 120 2838
A12 130 2839
A12 140 2840
A12 150 2841
A12 160 2842
A12 170 2843
A12 180 2844
A12 190 2845
A12 200 2846
A12 210 2847
A12 220 2848
A12 230 2849
A12 240 2850
A12 250 2851
A12 260 2852
A12 270 2853
A12 280 2854
A12 290 2855
A12 300 2856
A12 310 2857
A12 320 2858
A12 330 2859
A12 340 2860
A12 350 2861
A12 360 2862
A12 370 2863
A12 380 2864
A12 390 2865
A12 400 2866
A12 410 2867
A12 420 2868
A12 430 2869
A12 440 2870
A12 450 2871

V FOR A13,A13
C A13 10 2872
C A13 20 2873
C A13 30 2874
C SURROUNT VORTEX(P,B,D,TANA,GAMA, VI,VCOS ) A13 40 2875
C A13 50 2876
C * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *A13 60 2877
C * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *A13 70 2878
C A13 80 2879
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A13 90 2880
C DIMENSION P(3),B(3),D(3)
C DIMENSION COS(3),COS2(3),COS3(3), X(3),A(3),VCOS(3)
C DIMENSION G(3)
C COMMON/DATA01/ KIN, KOUT, KTL, KT2, KT3, KREC, KFILE, LIN, LINK
1 ,RAD, PIE, CUTOFF1, CUTOFF2, DELALF, LFLAP, LDRAG, COLOC
2 ,IFLG(20), EXEC(15)
C NAMELIST/DBUGV1/P,B,D,TANA,GAMA,PSIF,VCOS
NAMELIST/DBUGV2/PSIF,VCOS
NAMELIST/DBUGV3/PSIF,VCOS
C 1000 FORMAT(1X,/,1X)
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A13 100 2881
C A13 110 2882
C A13 120 2883
C A13 130 2884
C A13 140 2885
C A13 150 2886
C A13 160 2887
C A13 170 2888
C A13 180 2889
C A13 190 2890
C A13 200 2891
C A13 210 2892
C A13 220 2893
C A13 230 2894
C A13 240 2895
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A13 250 2896
C A13 260 2897
C A13 270 2898
C A13 280 2899
C NOTE= IFLG(20) - 8
TANAS= TANA**2
COSA= 1.0 - TANAS/2.0
IF (TANAS>0.0001) 1020,1010,1010
1010 COSA= 1.0/SQRT(TANAS+1.0)
1020 SINAS= COSA*TANA
C SCALE= SQRT((D(1)-B(1))**2+(D(2)-B(2))**2+(D(3)-B(3))**2)
00 1030 K=1,3
X(K)= (P(K)-0.5*(B(K)+D(K)))/SCALE
A(K)= (0.5*(D(K)-B(K)))/SCALE
1030 VCOS(K)= 0.0
C * SEGMENT INF-A-B *
C H5 = TANA*( X(1)+ A(1))
C
A13 290 2900
A13 300 2901
A13 310 2902
A13 320 2903
A13 330 2904
A13 340 2905
A13 350 2906
A13 360 2907
A13 370 2908
A13 380 2909
A13 390 2910
A13 400 2911
A13 410 2912
A13 420 2913
A13 430 2914
A13 440 2915
A13 450 2916
A13 460 2917
A13 470 2918

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HS1 = (X(1)+A(1))**2 + H5**2          A13  480      2919
HS2 = (X(2)+A(2))**2 + (X(3)+A(3)-H5)**2   A13  490      2920
HS3 = (X(1)+A(1))**2 + (X(2)+A(2))**2 + (X(3)+A(3))**2   A13  500      2921
H1 = SQRTHS1           A13  510      2922
H2 = SQRTHS2           A13  520      2923
C                                         A13  530      2924
COSG= 0.0                         A13  540      2925
SING= 1.0                         A13  550      2926
TEST = CUTOFL - H1                A13  560      2927
C                                         A13  570      2928
IF (TEST) 1040,1050,1050          A13  580      2929
1040 COSG= (HS3-HS1-HS2)/(2.0*H1*H2)    A13  590      2930
SING= SQRTHABS(1.0-COSG**2)          A13  600      2931
1050 CONTINUE                      A13  610      2932
C                                         A13  620      2933
R = H2*SING                       A13  630      2934
H4 = H2*COSG                      A13  640      2935
SH14= H1+H4                        A13  650      2936
C                                         A13  660      2937
PSIF= ( 1.0 +SH14/SQRT(SH14**2+R**2) )/R   A13  670      2938
C                                         A13  680      2939
COS1(1) = COSA                     A13  690      2940
COS1(2) = 0.0                      A13  700      2941
COS1(3) = SINA                     A13  710      2942
COS2(1) = ( X(1)+A(1)-SH14*COSA )/R   A13  720      2943
COS2(2) = ( X(2)+A(2) )/R          A13  730      2944
COS2(3) = ( X(3)+A(3)-SH14*SINA )/R   A13  740      2945
C                                         A13  750      2946
CALL CROSP(COS1,COS2,COS3)        A13  760      2947
C                                         A13  770      2948
DO 1060 K=1,3                    A13  780      2949
1060 VCOS(K)= PSIF*CCS3(K)
C                                         A13  790      2950
IF (NOTE) 1080,1070,1070          A13  800      2951
1070 WRITE (KOUT,1000)
WRITE (KOUT,DBUGV1)
1080 CONTINUE                      A13  820      2952
C                                         A13  830      2953
C                                         A13  840      2954
C                                         A13  850      2955
C                                         A13  860      2956
C                                         A13  870      2957
C                                         A13  880      2958
C                                         A13  890      2959
C                                         A13  900      2960
C                                         A13  910      2961
C                                         A13  920      2962
HS1 = (X(1)-A(1))**2 + H5**2          A13  930      2963
HS2 = (X(2)-A(2))**2 + (X(3)-A(3)-H5)**2   A13  940      2964
HS3 = (X(1)-A(1))**2 + (X(2)-A(2))**2 + (X(3)-A(3))**2   A13  950      2965
H1 = SQRTHS1           A13  960      2966
H2 = SQRTHS2           A13  970      2967
C                                         A13  980      2968
COSG= 0.0                         A13  990      2969
SING= 1.0                         A13 1000      2970
TEST = CUTOFL - H1                A13 1010      2971
C                                         A13 1020      2972
IF (TEST) 1090,1100,1100          A13 1030      2973
1090 COSG= (HS3-HS1-HS2)/(2.0*H1*H2)    A13 1040      2974
SING= SQRTHABS(1.0-COSG**2)
1100 CONTINUE                      A13 1050      2975
C                                         A13 1060      2976
R = H2*SING                       A13 1070      2977
H4 = H2*COSG                      A13 1080      2978
SH14= H1+H4                        A13 1090      2979
C                                         A13 1100      2980
PSIF= (-1.0 -SH14/SQRT(SH14**2+R**2) )/R   A13 1110      2981
C                                         A13 1120      2982
COS1(1)= COSA                     A13 1130      2983
COS1(2)= 0.0                      A13 1140      2984
COS1(3)= SINA                     A13 1150      2985
COS2(1)= ( X(1)-A(1)-SH14*COSA )/R   A13 1160      2986
COS2(2)= ( X(2)-A(2) )/R          A13 1170      2987
COS2(3)= ( X(3)-A(3)-SH14*SINA )/R   A13 1180      2988
C                                         A13 1190      2989
CALL CROSP(COS1,COS2,COS3)        A13 1200      2990
C                                         A13 1210      2991
DO 1110 K=1,3                    A13 1220      2992
1110 VCOS(K)= VCOS(K) + PSIF*COS3(K)
C                                         A13 1230      2993
IF (NOTE) 1130,1120,1120          A13 1240      2994
1120 WRITE (KOUT,DBUGV2)
1130 CONTINUE                      A13 1250      2995
C                                         A13 1260      2996
C                                         A13 1270      2997
C                                         A13 1280      2998
C                                         A13 1290      2999
C                                         A13 1300      3000
C                                         A13 1310      3001
C                                         A13 1320      3002
C                                         A13 1330      3003
C                                         A13 1340      3004
HS1 = 4.0*( A(1)**2 + A(2)**2 + A(3)**2 )   A13 1350      3005
HS2 = (X(1)-A(1))**2 + (X(2)-A(2))**2 + (X(3)-A(3))**2   A13 1360      3006
HS3 = (X(1)+A(1))**2 + (X(2)+A(2))**2 + (X(3)+A(3))**2   A13 1370      3007
H1 = SQRTHS1           A13 1380      3008
H2 = SQRTHS2           A13 1390      3009
COSG= (HS3-HS1-HS2)/(2.0*H1*H2)    A13 1400      3010
SING= SQRTHABS(1.0-COSG**2)
PSIF= 0.0
TEST = ABS(SING) - CUTOF2
C                                         A13 1410      3011
IF (TEST) 1170,1170,1140          A13 1420      3012
1140 CONTINUE                      A13 1430      3013
C                                         A13 1440      3014
R = H2*SING                       A13 1450      3015
C                                         A13 1460      3016
TEST = R/H1 - 10.0*CUTOFL        A13 1470      3017
IF (TEST) 1170,1170,1150          A13 1480      3018
1150 CONTINUE                      A13 1490      3019
C                                         A13 1500      3020
RS = R**2                         A13 1510      3021
A13 1520      3022
A13 1530      3023
A13 1530      3024

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H4 = H2*COSG
SH14= H1+H4
T1= 1.0 + 2.0*H4/H1
C
PSIF= (SH14/SQRT(SH14**2+RS) -H4/SQRT(H4**2+RS))/R
C
DO 1160 K=1,3
G(K)= A(K)*T1
COS1(K)= (G(K)-X(K))/R
1160 COS2(K)= -2.0*A(K)/H1
C
CALL CROSP(COS1,CCS2,COS3)
C
1170 CONTINUE
C
V2= 0.0
C
DO 1180 K=1,3
VCOS(K)= VCOS(K) + PSIF*COS3(K)
1180 V2= V2 + VCOS(K)**2
C
IF (NOTE) 1200,1190,1190
1190 WRITE (KOUT,DEBUGV3)
LIN= LINX - 10
1200 CONTINUE
C
VI= SQRT(V2)
DO 1210 K=1,3
1210 VCOS(K)= VCOS(K)/VI
C
VI= VI*(GAMA/SCALE)
C
RETURN
C
XXXXXX
C
END

A13 1540      3025
A13 1550      3026
A13 1560      3027
A13 1570      3028
A13 1580      3029
A13 1590      3030
A13 1600      3031
A13 1610      3032
A13 1620      3033
A13 1630      3034
A13 1640      3035
A13 1650      3036
A13 1660      3037
A13 1670      3038
A13 1680      3039
A13 1690      3040
A13 1700      3041
A13 1710      3042
A13 1720      3043
A13 1730      3044
A13 1740      3045
A13 1750      3046
A13 1760      3047
A13 1770      3048
A13 1780      3049
A13 1790      3050
A13 1800      3051
A13 1810      3052
A13 1820      3053
A13 1830      3054
A13 1840      3055
A13 1850      3056
A13 1860      3057
A13 1870      3058
A13 1880      3059
A13 1890      3060

A14 10       3061
A14 20       3062
A14 30       3063
A14 40       3064
A14 50       3065
A14 60       3066
A14 70       3067
A14 80       3068
A14 90       3069
A14 100      3070
A14 110      3071
A14 120      3072
A14 130      3073
A14 140      3074
A14 150      3075
A14 160      3076
A14 170      3077
A14 180      3078
A14 190      3079
A14 200      3080
A14 210      3081
A14 220      3082
A14 230      3083
A14 240      3084
A14 250      3085
A14 260      3086
A14 270      3087
A14 280      3088
A14 290      3089
A14 300      3090
A14 310      3091
A14 320      3092
A14 330      3093
A14 340      3094
A14 350      3095
A14 360      3096
A14 370      3097
A14 380      3098
A14 390      3099
A14 400      3100
A14 410      3101
A14 420      3102
A14 430      3103
A14 440      3104
A14 450      3105
A14 460      3106
A14 470      3107
A14 480      3108
A14 490      3109
A14 500      3110
A14 510      3111
A14 520      3112
A14 530      3113
A14 540      3114
A14 550      3115
A14 560      3116
A14 570      3117
A14 580      3118
A14 590      3119
A14 600      3120
A14 610      3121
A14 620      3122
A14 630      3123
A14 640      3124
A14 650      3125
A14 660      3126
A14 670      3127

A14 1170      3111
A14 1180      3112
A14 1190      3113
A14 1200      3114
A14 1210      3115
A14 1220      3116
A14 1230      3117
A14 1240      3118
A14 1250      3119
A14 1260      3120
A14 1270      3121
A14 1280      3122
A14 1290      3123
A14 1300      3124
A14 1310      3125
A14 1320      3126
A14 1330      3127

A14 1170      3111
A14 1180      3112
A14 1190      3113
A14 1200      3114
A14 1210      3115
A14 1220      3116
A14 1230      3117
A14 1240      3118
A14 1250      3119
A14 1260      3120
A14 1270      3121
A14 1280      3122
A14 1290      3123
A14 1300      3124
A14 1310      3125
A14 1320      3126
A14 1330      3127

A14 1170      3111
A14 1180      3112
A14 1190      3113
A14 1200      3114
A14 1210      3115
A14 1220      3116
A14 1230      3117
A14 1240      3118
A14 1250      3119
A14 1260      3120
A14 1270      3121
A14 1280      3122
A14 1290      3123
A14 1300      3124
A14 1310      3125
A14 1320      3126
A14 1330      3127

A14 1170      3111
A14 1180      3112
A14 1190      3113
A14 1200      3114
A14 1210      3115
A14 1220      3116
A14 1230      3117
A14 1240      3118
A14 1250      3119
A14 1260      3120
A14 1270      3121
A14 1280      3122
A14 1290      3123
A14 1300      3124
A14 1310      3125
A14 1320      3126
A14 1330      3127

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1280 SWAP=B(IROW,L) A14 680 3128
1290 B(IROW,L)=B(ICOLUMN,L) A14 690 3129
1300 B(ICOLUMN,L)=SWAP A14 700 3130
1310 INDEX(I,1)=IROW A14 710 3131
1320 INDEX(I,2)=ICOLUMN A14 720 3132
1330 PIVOT=A(ICOLUMN,ICOLUMN) A14 730 3133
    IF (PIVOT) 1340,1180,1340 A14 740 3134
C      SCALE THE DETERMINANT A14 750 3135
C
1340 PIVOT=PIVOT A14 760 3136
1350 IF (DABS(DETERM)-R1) 1380,1360,1360 A14 770 3137
1360 DETERM=DETERM/R1 A14 780 3138
    ISCALE=ISCALE+1 A14 790 3139
    IF (DABS(DETERM)-R1) 1410,1370,1370 A14 800 3140
1370 DETERM=DETERM/R1 A14 810 3141
    ISCALE=ISCALE+1 A14 820 3142
    GO TO 1410 A14 830 3143
1380 IF (DABS(DETERM)-R2) 1390,1390,1410 A14 840 3144
1390 DETERM=DETERM*R1 A14 850 3145
    ISCALE=ISCALE-1 A14 860 3146
    IF (DABS(DETERM)-R2) 1400,1400,1410 A14 870 3147
1400 DETERM=DETERM*R1 A14 880 3148
    ISCALE=ISCALE-1 A14 890 3149
1410 IF (DABS(PIVOT)-R1) 1440,1420,1420 A14 900 3150
1420 PIVOT=PIVOT/R1 A14 910 3151
    ISCALE=ISCALE+1 A14 920 3152
    IF (DABS(PIVOT)-R1) 1470,1430,1430 A14 930 3153
1430 PIVOT=PIVOT/R1 A14 940 3154
    ISCALE=ISCALE+1 A14 950 3155
    GO TO 1470 A14 960 3156
1440 IF (DABS(PIVOT)-R2) 1450,1450,1470 A14 970 3157
1450 PIVOT=PIVOT*R1 A14 980 3158
    ISCALE=ISCALE-1 A14 990 3159
    IF (DABS(PIVOT)-R2) 1460,1460,1470 A14 1000 3160
1460 PIVOT=PIVOT*R1 A14 1010 3161
    ISCALE=ISCALE-1 A14 1020 3162
1470 DETERM=DETERM*PIVOT A14 1030 3163
    ISCALE=ISCALE-1 A14 1040 3164
    DETERM=DETERM*PIVOT A14 1050 3165
C      DIVIDE PIVOT ROW BY PIVOT ELEMENT A14 1060 3166
C
1480 A(ICOLUMN,ICOLUMN)=1.0 A14 1070 3167
1490 DO 1500 L=1,N A14 1080 3168
1500 A(ICOLUMN,L)=A(ICOLUMN,L)/PIVOT A14 1090 3169
C
1510 IF (M) 1540,1540,1520 A14 1100 3170
1520 DO 1530 L=1,M A14 1110 3171
1530 B(ICOLUMN,L)=B(ICOLUMN,L)/PIVOT A14 1120 3172
C
C      REDUCE NON-PIVOT ROWS A14 1130 3173
C
1540 DO 1630 L1=L,N A14 1140 3174
1550 IF (L1-ICOLUMN) 1560,1630,1560 A14 1150 3175
1560 T=A(L1,ICOLUMN) A14 1160 3176
1570 A(L1,ICOLUMN)=0.0 A14 1170 3177
1580 DO 1590 L=1,N A14 1180 3178
1590 A(L1,L)=A(L1,L)-A(ICOLUMN,L)*T A14 1190 3179
C
1600 IF (M) 1630,1630,1610 A14 1200 3180
1610 DO 1620 L=1,M A14 1210 3181
1620 B(L1,L)=B(L1,L)-B(ICOLUMN,L)*T A14 1220 3182
1630 CONTINUE A14 1230 3183
C
C      INTERCHANGE COLUMNS A14 1240 3184
C
1640 DO 1740 I=1,N A14 1250 3185
1650 L=N+I-1 A14 1260 3186
1660 IF (INDEX(L,1)-INDEX(L,2)) 1670,1740,1670 A14 1270 3187
1670 JROW=INDEX(L,1) A14 1280 3188
1680 JCOLUMN=INDEX(L,2) A14 1290 3189
1690 DO 1730 K=1,N A14 1300 3190
1700 SWAP=A(K,JROW) A14 1310 3191
1710 A(K,JROW)=A(K,JCOLUMN) A14 1320 3192
1720 A(K,JCOLUMN)=SWAP A14 1330 3193
1730 CONTINUE A14 1340 3194
1740 CONTINUE A14 1350 3195
1750 RETURN A14 1360 3196
C      XXXXXX A14 1370 3197
C
1640 DO 1740 I=1,N A14 1380 3198
1650 L=N+I-1 A14 1390 3199
1660 IF (INDEX(L,1)-INDEX(L,2)) 1670,1740,1670 A14 1400 3200
1670 JROW=INDEX(L,1) A14 1410 3201
1680 JCOLUMN=INDEX(L,2) A14 1420 3202
1690 DO 1730 K=1,N A14 1430 3203
1700 SWAP=A(K,JROW) A14 1440 3204
1710 A(K,JROW)=A(K,JCOLUMN) A14 1450 3205
1720 A(K,JCOLUMN)=SWAP A14 1460 3206
1730 CONTINUE A14 1470 3207
1740 CONTINUE A14 1480 3208
1750 RETURN A14 1490 3209
C      END
C
V FOR A15,A15 A15 10 3210
C
C      SUBROUTINE DOTP(A,B,C) A15 20 3211
C
C      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG-72 *A15 30 3212
C      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *A15 40 3213
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX A15 50 3214
C
C      DIMENSION A(3),B(3) A15 60 3215
C      C= A(1)*B(1)+ A(2)*B(2)+ A(3)*B(3) A15 70 3216
C
C      RETURN A15 80 3217
C      XXXXXX A15 90 3218
C
C      END A15 100 3219
A15 110 3220
A15 120 3221
A15 130 3222
A15 140 3223
A15 150 3224
A15 160 3225
A15 170 3226

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V FOR A16,A16 A16 10 3227

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C          A16   20      3228
C          A16   30      3229
C          A16   40      3230
C          A16   50      3231
C          * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *A16 60 3232
C          * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *A16 70 3233
C          A16   80      3234
C          XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXA16 90 3235
C          A16  100     3236
C          DIMENSION A(3),B(3),C(3)          A16 110     3237
C          C(1)= A(2)*B(3) - A(3)*B(2)          A16 120     3238
C          C(2)= A(3)*B(1) - A(1)*B(3)          A16 130     3239
C          C(3)= A(1)*B(2) - A(2)*B(1)          A16 140     3240
C          A16 150     3241
C          RETURN          A16 160     3242
C          XXXXXX          A16 170     3243
C          A16 180     3244
C          A16 190     3245
C          END          A16 200     3246

V FOR A17,A17          A17   10      3247
C          A17   20      3248
C          A17   30      3249
C          SUBROUTINE PAGE          A17  40      3250
C          * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *A17 60 3251
C          * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *A17 70 3252
C          A17  80      3253
C          XXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXA17 90 3254
C          A17 100     3255
C          DIMENSION AILRDX(2)          A17 110     3256
C          COMMON/DATA00/ TITLE(14), ALFA0, ZHO, CMAK          A17 120     3257
C          COMMON/DATA01/ KIN, KOUT, KTL, KT2, KT3, KREC, KFILE, LIN, LNK          A17 130     3258
C          1 ,RAD, P1E, CUTOFF1, CUTOFF2, DELALF, LFLAP, LDRAG, COLOC          A17 140     3259
C          2 +IFLG(20), EXCK(15)          A17 150     3260
C          A17 160     3261
C          A17 170     3262
C          A17 180     3263
C          A17 190     3264
C          A17 200     3265
C          1000 FORMAT(TOH1JOBFLAG, I1 2 3 4 5 6 7 8 9 10 11 12 13 14 I5 16)A17 200 3266
C          1 17 18 19 20 ,9A6,6H PAGE,/,          A17 210 3267
C          2 2X,5HVALUE,LX,20I3, 7X,5HALFA=,F6.2,9H MACHNO=,F6.4,11H ALTITUDEA17 220 3268
C          3F=,F6.2, 7X,I4,/,/,1X)          A17 230 3269
C          A17 240     3270
C          A17 250     3271
C          XXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXA17 260 3272
C          A17 270     3273
C          A17 280     3274
C          IF (INSTU-1971) I10,1020,1010          A17 290 3275
C          1010 INSTU= 1971          A17 300 3276
C          FLAPDX = 0.0          A17 310 3277
C          AILRDX(1)= 0.0          A17 320 3278
C          AILRDX(2)= 0.0          A17 330 3279
C          NP = 0          A17 340 3280
C          1020 NP= NP+1          A17 350 3281
C          WRITE (KOUT,1000)(TITLE(I),I=1,9),(IFLG(I)),I=1,20),ALFA0,CMAK,ZHO,A17 360 3282
C          *NP          A17 370 3283
C          LIN= 5          A17 380 3284
C          RETURN          A17 390 3285
C          XXXXXX          A17 400 3286
C          A17 410 3287
C          A17 420 3288
C          END          A17 430 3289

V FOR A18,A18          A18   10      3290
C          A18   20      3291
C          A18   30      3292
C          MAIN ROUTINE          A18  40      3293
C          TEST MATRIX INVERSION          A18  50      3294
C          * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *A18 70 3295
C          * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *A18 80 3296
C          A18  90      3297
C          XXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXA18 100 3298
C          A18 110     3299
C          DOUBLE PRECISION DELTA,AMAT(60,60),CMAT(60,60)          A18 120 3300
C          DOUBLE PRECISION BMAT(100,100)          A18 130 3301
C          A18 140     3302
C          1000 FORMAT((10X,15.2F14.4) )          A18 150 3303
C          1010 FORMAT( 1X,/,1X )          A18 160 3304
C          1020 FORMAT((10X,5(1PE14.6) ))          A18 170 3305
C          XXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXA18 180 3306
C          A18 190     3307
C          A18 200     3308
C          A18 210     3309
C          A18 220     3310
C          A18 230     3311
C          NDR= 5          A18 240 3312
C          AMAT(1,1) = 1.032          A18 250 3313
C          AMAT(1,2) = 7.865          A18 260 3314
C          AMAT(1,3) = 3.216          A18 270 3315
C          AMAT(1,4) = 3.031          A18 280 3316
C          AMAT(1,5) = 10.32          A18 290 3317
C          AMAT(2,1) = 7.68          A18 300 3318
C          AMAT(2,2) = -6.39          A18 310 3319
C          AMAT(2,3) = 8.900          A18 320 3320
C          AMAT(2,4) = -1.03          A18 330 3321
C          AMAT(2,5) = 5.690          A18 340 3322
C          AMAT(3,1) = 3.030          A18 350 3323
C          AMAT(3,2) = -3.38          A18 360 3324
C          AMAT(3,3) = -11.67          A18 370 3325
C          AMAT(3,4) = 4.190          A18 380 3326
C

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      BMAT(3,5) = -3.60          A18 390    3328
      AMAT(4,1) = -2.93          A18 400    3329
      AMAT(4,2) = 5.670          A18 410    3330
      AMAT(4,3) = 8.323          A18 420    3331
      AMAT(4,4) = 9.072          A18 430    3332
      AMAT(4,5) = 0.0378         A18 440    3333
      AMAT(5,1) = -.0578         A18 450    3334
      AMAT(5,2) = 7.103          A18 460    3335
      AMAT(5,3) = 9.992          A18 470    3336
      AMAT(5,4) = 0.978          A18 480    3337
      AMAT(5,5) = 15.14          A18 490    3338
C
C      DO 1040 J=1,NOR
C      DO 1030 K=1,NOR
1030  BMAT(J,K)= AMAT(J,K)
1040  CONTINUE
C
C      CALL DMATIN(BMAT,NOR,DELTA)
C
C      DO 1070 K=L,NOR
C      DO 1060 J=1,NOR
C      CMAT(J,K)= D_0
C      DO 1050 L=L,NOR
1050  CMAT(J,K)= CMAT(J,K) + AMAT(J,L)*BMAT(L,K)
1060  CONTINUE
1070  CONTINUE
C
C      CALL PAGE
      WRITE (6,1020)((AMAT(J,K),J=1,NOR),K=1,NOR)
      WRITE (6,1010)
      WRITE (6,1020)((BMAT(J,K),J=1,NCR),K=1,NOR)
      WRITE (6,1010)
      WRITE (6,1020)((CMAT(J,K),J=1,NOR),K=1,NOR)
      WRITE (6,1010)
      WRITE (6,1020)((CMAT(J,K),J=1,NOR),K=1,NOR)
      WRITE (6,1010)
      WRITE (6,1010)
      WRITE (6,1020)DELTA
      STOP
      END
A18 500    3339
A18 510    3340
A18 520    3341
A18 530    3342
A18 540    3343
A18 550    3344
A18 560    3345
A18 570    3346
A18 580    3347
A18 590    3348
A18 600    3349
A18 610    3350
A18 620    3351
A18 630    3352
A18 640    3353
A18 650    3354
A18 660    3355
A18 670    3356
A18 680    3357
A18 690    3358
A18 700    3359
A18 710    3360
A18 720    3361
A18 730    3362
A18 740    3363
A18 750    3364
A18 760    3365

      V FOR B01,B01
B01 10    3366
B01 20    3367
B01 30    3368
B01 40    3369
C
C      * MAIN ROUTINE WING /WING LIFT PROGRAM HAD10B/REVISED 15 MARCH 71 *B01
B01 50    3370
B01 60    3371
C
C      * THEORY AND PROGRAM DEVELOPED BY ANTONIO V. GOMEZ, STAFF ENGINEER * B01
B01 70    3372
C
C      * TRW SYSTEMS GROUP, DIVISION OF TRW INC., HOUSTON, TEXAS - 77058 * B01
B01 80    3373
C
C      * VERSION 2 ROUTINE (DOUBLE PRECISION-LANGLEY MATINV SUBROUTINE) * B01
B01 90    3374
C
B01 100   3375
C
C      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *B01
B01 110   3376
C
C      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *B01
B01 120   3377
C
B01 130   3378
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXB01
B01 140   3379
C
B01 150   3380
C
      REAL MACHN(10)
      DIMENSION COMMTS(42)
      DIMENSION YSPAN(42)
      DIMENSION WCL(21),ALFA(20),HEIGHT(10)
      DIMENSION FLAPO(10), AILRND(2,10)
      DIMENSION FLAPDJ(10), ATLDJ(2,10)
C
      COMMON/DATA00/NSTL ,ALFA0 ,CMAK ,ZHD ,FLAPDX,AILRDX(2)
      * ,TITLE(14) ,STORE(14)
B01 230   3388
B01 240   3389
B01 250   3390
B01 260   3391
B01 270   3392
B01 280   3393
B01 290   3394
B01 300   3395
B01 310   3396
B01 320   3397
B01 330   3398
B01 340   3399
B01 350   3400
B01 360   3401
B01 370   3402
B01 380   3403
B01 390   3404
B01 400   3405
B01 410   3406
B01 420   3407
B01 430   3408
B01 440   3409
B01 450   3410
B01 460   3411
B01 470   3412
B01 480   3413
B01 490   3414
B01 500   3415
B01 510   3416
B01 520   3417
B01 530   3418
B01 540   3419
B01 550   3420
B01 560   3421
B01 570   3422
B01 580   3423
B01 590   3424
B01 600   3425
B01 610   3426
B01 620   3427
B01 630   3428
B01 640   3429
B01 650   3430

      EQUIVALENCE (LINKX,LINFX),(NSS,NYS),(XOCR,XOCREF)
      EQUIVALENCE (WFLAP1,YFLAP1),(WFLAP2,YFLAP2),(WFLAP3,YAILRN)
      EQUIVALENCE (FLAPDJ,FLAPD),(AILDJ,AILRND)
C
      NAMELIST/INPUT/ KOUT, KTL, KT2, KT3, LINK, COLOC,
      1 CUTOFF1, CUTOFF2, LFLAP, LDRAG, PMECF, DELALF,
      2 NSS, NCS, X, Y, Z, E, G, XOC, ZOC, XOCR,
      3 WFLAP1,WFLAP2,WFLAP3,FLAPC, WSMOTH, YSPAN,
      4 NJOB, NJOBL, ALFA, MACHN, HEIGHT, FLAPDJ, AILDJ, WCL, CLEANF,
      5 IFLG
C
      DATA TEST/6H $ENDJ/
      DATA NJOB/1/, NJOBL/20/, ALFA/20*0.0/
      DATA WCL/1.0, -0.4,-0.3,-0.2,-0.1,0.0,0.1,0.2,0.3,0.4,0.5,0.6,
      * 0.8,0.9,1.0,1.1,1.2,1.3,1.4,1.5,1.6/
      DATA MACHN/10*0.0/, HEIGHT/10*10000.0/
      DATA AILRND/20*0.0/, FLAPD/10*0.0/
      DATA PMECF/1.0/, COLOC/0.75/, CLEANF/0.0035/, DELALF/1.0/
C
C      1000 FORMAT(13A6,A2)
C
      1010 FORMAT(//,15X,14H*** JOB TIME=,14,16H / ELAPSED TIME=,14,
      1 17H / ND.PLOT FILES=,14,35H / ISURF EXEC. VERSION 6-18-72 ***,
      1 17H / ND.PLOT FILES=,14,35H / ISURF EXEC. VERSION 6-18-72 ***,
      1 17H / ND.PLOT FILES=,14,35H / ISURF EXEC. VERSION 6-18-72 ***,
      1 17H / ND.PLOT FILES=,14,35H / ISURF EXEC. VERSION 6-18-72 ***,
      1 17H / ND.PLOT FILES=,14,35H / ISURF EXEC. VERSION 6-18-72 ***

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      2 //,15X,47{2H**},/,15X,47{2H**} )
C   1020 FORMAT(1H1,10X,35H*** J0BS INPUT LIST-CONTINUED ****,/,1X )
1030 FORMAT(1X,13A6,A2)
1040 FORMAT(1X,1)H7 XCT ISURF
C   1050 FORMAT(1H1,/,/,/,29X,
1 63HSUBSONIC-FLO LIFTING SURFACE ANALYSIS PROGRAM HA010B,/,37X,
2 36HTRW SYSTEMS INC., HOUSTON OPERATIONS,/,46X,
3 22HHOUSTON, TEXAS (77058),/,16X,
4 25H*** J0BS INPUT LIST ****,/,1X )
C   C
C   XXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C   C
C   CALL BLKDAT
REWIND K1
WRITE (KDOUT,1050)
WRITE (KDOUT,1050)
WRITE (KDOUT,1040)
LINES= 15
1060 READ (KIN,1000)(STORE(I),I=1,14)
WRITE (K1,1000)(STORE(I),I=1,14)
IF (LINES-LINES1) 1070,1080,1080
1070 WRITE (KDOUT,1020)
LINES= 3
1080 LINES= LINES+1
WRITE (KDOUT,1030)(STORE(I),I=1,14)
C   IF (STORE(1).NE.TEST1) GO TO 1060
END FILE K1
REWIND K1
WRITE (KDOUT,1040)
C   NCOMT=-1
NCALCP==1
ISUM = 0.0
CALL RESET
C   C
1090 READ (K1,1000)(TITLE(I),I=1,14)
IF (TITLE(1).EQ.TEST1) CALL EXIT
IF (NCOMT) 1100,1100,1110
1100 READ (K1,1000)(COMMTS(I),I=1,42)
1110 NCOMT= 1
READ (K1,INPUT)
ALFA0= 1.0E+10
ZHO = 1.0E+10
FXCK(10)= CLEANF
FXCK(11)= COLOCF
FXCK(12)= DELALF
FXCK(13)= PMECF
IPLOTK= IFLG(12) + IFLG(13) + IFLG(14) - 1
C   IF (NCALCP) 1120,1120,1140
1120 NCALCP= 1
IF (IPLOTK) 1140,1130,1130
1130 REWIND KT2
IFLG(15)= 0
1140 CONTINUE
C   C
CALL PAGE
WRITE (KDOUT,INPUT)
C   ITEST=70-(IFLG(6)*IFLG(3))/2-IFLG(1)
IF (ITEST) 1150,1160,1160
1150 IFLG(3)= 70*(2-[IFLG(1)/IFLG(6)]
1160 IFLGX3= 21*(2/[IFLG(1)+1])
IF ([IFLGX3-IFLG(3)] 1170,1180,1180
1170 IFLG(3)= IFLGX3
1180 CONTINUE
C   AILRDX(1) = AILRND(1,1) + AILRND(1,2)
AILRDX(2) = AILRND(2,1) + AILRND(2,2)
FLAPDX= FLAPD(1) + FLAPD(2)
C   NJAILR = 0
NOFLAP= 0
IFLG(1)= 0
UTEST= ABS( AILRDX(1) - AILRDX(2) ) - 0.5
C   IF (UTEST) 1200,1200,1190
1190 IFLG(1)= 1
NOAILP= 2
1200 IF (FLAPDX) 1210,1220,1210
1210 NOFLAP = 2
1220 NOFLPX= NOFLAP + NOAILP
IF (NOFLPX) 1290,1290,1230
1230 IF (IFLG(5)) 1240,1240,1250
1240 IFLG(5)= 1
1250 IF (IFLG(6)-1) 1260,1260,1270
1260 IFLG(6)= 2
1270 IF (IFLG(2)-5) 1290,1280,1290
1280 IFLG(2)= 4
1290 CONTINUE
C   AILRDX(1) = 0.0
AILRDX(2) = 0.0
FLAPDX= 0.0
NJORBX= NJORL+1
C   C
CALL LDFT(EYSPAN)

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.C          DD 1360 N=1,NJOB          B01 1720      3537
.C          ALFA0= ALFA(N)          B01 1730      3538
.C          HEIGT= HEIGHT(N)       B01 1740      3539
.C          ALFAD= ALFA0          B01 1750      3540
.C          ZHO = HEIGT          B01 1760      3541
.C          CMAK = 0.0           B01 1770      3542
.C          EXECK(1)= 1.0         B01 1780      3543
1300 CMAN = MACHN(N)          B01 1790      3544
.C          EXECK(1)= SQRT(1.0-CMAK**2) B01 1800      3545
1310 FLAPDX= FLAPO(N)         B01 1810      3546
.AILRDX(1)= AILRND(1,N)       B01 1820      3547
.AILRDX(2)= AILRND(2,N)       B01 1830      3548
.C          CALL DLTF(1,ALFAD,HEIGT) B01 1840      3549
.C          IF ITFLG(8)-1 1330,1320,1320          B01 1850      3550
1320 CALL DLINERIALFAC,HEIGT,ALFA,WCL,NJOBX) B01 1860      3551
1330 CONTINUE                  B01 1870      3552
.C          CALL DLTF(1,ALFAD,HEIGT) B01 1880      3553
.C          IF ITFLG(8)-1 1330,1320,1320          B01 1890      3554
B01 1900      3555
B01 1910      3556
B01 1920      3557
B01 1930      3558
B01 1940      3559
B01 1950      3560
B01 1960      3561
B01 1970      3562
B01 1980      3563
B01 1990      3564
B01 2000      3565
B01 2010      3566
B01 2020      3567
B01 2030      3568
B01 2040      3569
B01 2050      3570
B01 2060      3571
B01 2070      3572
B01 2080      3573
B01 2090      3574
B01 2100      3575
B01 2110      3576

V FOR B02,B02          B02  10      3577
C          B02  20      3578
C          B02  30      3579
C          B02  40      3580
C          SUBROUTINE BLKDAT          B02  50      3581
C          * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *B02  70      3582
C          * PROGRAM DEVELOPED BY A. V. GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *B02  80      3583
C          *B02  90      3584
C          XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX B02 100      3585
C          B02 110      3586
C          COMMON/DATA00/NSTL ,ALFA0 ,CMAK ,ZHO ,FLAPDX,AILRDX(2) B02 120      3587
C          * ,TITLE(14) ,STORE(14)          B02 130      3588
C          B02 140      3589
C          COMMON/DATA01/KIN ,KOUT ,KT1 ,KT2 ,LINEX +LINES          B02 150      3590
C          B02 160      3591
C          COMMON/DATA02/IFLG(15) ,EXECK(15) ,RAD ,PIE          B02 170      3592
C          B02 180      3593
C          COMMON/DATA03/NYS ,NCS ,XDCREF,X(10) ,Y(10) ,Z(10) ,E(10) B02 190      3594
C          * ,C(10) ,ZDC(10) ,10) ,XOC(10)          B02 200      3595
C          B02 210      3596
C          COMMON/DATA04/YFLAPI,YFLAP2,FLAPC          B02 220      3597
C          * ,YATLRN,AILRNC,WSMOTH          B02 230      3598
C          B02 240      3599
C          COMMON/DATA05/WINGD(15) ,FY(42,10) ,EC(42,10) ,ES(42,10) B02 250      3600
C          *,EYE(10) ,FLE(10) ,EYE(10) ,EHE(10) ,EG(42,10)          B02 260      3601
C          *,EN(42,10,6) ,EV(42,10,6) ,VVINDX(42,10,3)          B02 270      3602
C          B02 280      3603
C          COMMON/DATA06/YFF11,YFF12,YFF21,YFF22,YFF31,YFF32,DELT1,DELT2 B02 290      3604
C          * ,NOFLAP,NOAILR          B02 300      3605
C          B02 310      3606
C          COMMON/DATA07/LFLAP,LDRAG,CUTOFL,CUTOF2          B02 320      3607
C          B02 330      3608
C          B02 340      3609
C          DATA NSTU/1, ALFA0/0.0/, CMAK/0.0/, ZHO/10000.0/, FLAPDX/0.0/, B02 350      3610
C          * AILRDX/2*0.0/          B02 360      3611
C          B02 370      3612
C          DATA KIN/5/, KOU1/6/, KT1/1/, KT2/8/, LINEX/56/, LINES/0/          B02 380      3613
C          B02 390      3614
C          DATA IFLG/0,0,10,0,0,1,0,0,0,1,5*0/, EXECK/15*0.0/, RAD/57.29578/, B02 400      3615
C          * PIE/3.14159/          B02 410      3616
C          DATA NYS/2/,NCS/2/,XOCREF/0.25/,X/10*0.0/,Y/0.0,100.0,8*1000.0/, B02 420      3617
C          * Z/10*0.0/,F/10*0.0/,C/10*100.0/,ZDC/100*0.0/,XDC/0.0,1.0,8*0.0/ B02 430      3618
C          B02 440      3619
C          B02 450      3620
C          DATA YFLAPI/0.0/, YFLAP2/0.6/, FLAPC/0.3/, YATLRN/1.3/, ALLRNC/.3/B02 460      3621
C          *, WSMOTH/0.20/          B02 470      3622
C          B02 480      3623
C          DATA LFLAP/0/, LDRAG/0/, CUTOFL/0.0001/, CUTOF2/0.0029/ B02 490      3624
C          B02 500      3625
C          XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX B02 510      3626
C          B02 520      3627
C          RETURN          B02 530      3628
C          B02 540      3629
C          END          B02 550      3630

V FOR B03,B03          B03  10      3631
C          B03  20      3632
C          B03  30      3633
C          B03  40      3634
C          B03  50      3635
C          SUBROUTINE LOFT(YSPAN)          B03  50      3636

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C * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *B03 60 3637
C * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *B03 70 3638
C *XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXB03 80 3639
C *XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXB03 90 3640
C *DIMENSION X(10),Y(10),XC(10) B03 100 3641
C *DIMENSION YSPAN(42) B03 110 3642
C *DIMENSION COS1(3),COS2(3),COS3(3) B03 120 3643
C *DIMENSION ZACY(10) B03 130 3644
C COMMON/DATA01/KIN ,KOUT ,KT1 ,KT2 ,LINE ,LINES B03 140 3645
C COMMON/DATA02/IFLG(15) ,FXECK(15) ,RAD ,PIE B03 150 3646
C COMMON/DATA03/NYS ,NES ,XOCREF,X(10) ,Y(10) ,Z(10) ,E(10) B03 160 3647
C * ,C(10) ,ZOC(10 ,10) ,XOC(10) B03 170 3648
C COMMON/DATA04/YFLAP1,YFLAP2,FLAPC B03 180 3649
C * ,YATLRN,AIRN,WSMOTH B03 190 3650
C COMMON/DATA05/WINGD(5) ,FY(42,10) ,EC(42,10) ,ES(42,10) B03 200 3651
C *,EYF(10) ,ELE(10) ,ETE(10) ,EHE(10) ,FG(42,10) B03 210 3652
C *,EN(42,10,6) ,EV(42,10,6) ,VVINDX(42,10,3) B03 220 3653
C COMMON/DATA06/YFF11,YFF12,YFF21,YFF22,YFF31,YFF32,DELT1,DELT2 B03 230 3654
C * ,NOFLAP,NOAILR B03 240 3655
C COMMON/DATA07/WINGD(5) ,FY(42,10) ,EC(42,10) ,ES(42,10) B03 250 3656
C *,EYF(10) ,ELE(10) ,ETE(10) ,EHE(10) ,FG(42,10) B03 260 3657
C *,EN(42,10,6) ,EV(42,10,6) ,VVINDX(42,10,3) B03 270 3658
C COMMON/DATA08/YFF11,YFF12,YFF21,YFF22,YFF31,YFF32,DELT1,DELT2 B03 280 3659
C * ,NOFLAP,NOAILR B03 290 3660
C COMMON/DATA09/YFF11,YFF12,YFF21,YFF22,YFF31,YFF32,DELT1,DELT2 B03 300 3661
C * ,NOFLAP,NOAILR B03 310 3662
C COMMON/DATA10/YFF11,YFF12,YFF21,YFF22,YFF31,YFF32,DELT1,DELT2 B03 320 3663
C * ,NOFLAP,NOAILR B03 330 3664
C COMMON/DATA11/YFF11,YFF12,YFF21,YFF22,YFF31,YFF32,DELT1,DELT2 B03 340 3665
C * ,NOFLAP,NOAILR B03 350 3666
C 1000 FORMAT(1X,/,1X)
C 1010 FORMAT(53X,13HWING GEOMETRY,/,53X,13(LH*),/,1X,
C   1 60H SPAN ROOT TIP ROOT TIP AREA , B03 370 3668
C   2 59H ASPECT MFAN MGC YBAR XBAR ZBAR/, B03 380 3669
C   361H CHORD CHORD TWIST TWIST , B03 390 3670
C   4 60H RATIO CHORD (MAC) (MGC) (MGC), B03 400 3671
C   5,1X,3F10.3,2F10.4,F10.2,F10.4,5F10.3,/,1X, B03 420 3673
C   6 60H FLAP FLAP FLAP AIRLN AIRLN AIRLN B03 430 3674
C   7 60H DIHED SWEEP NO,SPAN NO,SPAN NO,CHORD NO,CHORD/, B03 440 3675
C   861H SPAN1 SPAN2 CHORD SPAN1 SPAN2 CHORD, B03 450 3676
C   9 60H 1/4MGC 1/4MGC VORTICES DISCONT VORTICES DISCONT/, B03 460 3677
C   */,1X,2(2F10.3,F10.4),2F10.3,17,3I10,/,1X ) B03 470 3678
C
C 1020 FORMAT(1X)
C 1030 FORMAT(1X,
C   1 60H 2Y/R Y XLE X(1/4) XHE XTE , B03 510 3682
C   2 60H Z E SWEEP C/4 DIHED C CF , B03 520 3683
C   3 /,1X) B03 530 3684
C 1040 FORMAT( 1X, 12F10.3 )
C 1050 FORMAT(21X,50H XA(1)/C XA(2)/C XA(3)/C XA(4)/C XA(5)/C, B03 570 3688
C   1 50H XA(6)/C XA(7)/C XA(8)/C XA(9)/C XA(10)/C,/,21X, B03 580 3689
C   2 1D10.4,/,1X, 40H Y 2Y/R , ZA(1)/C, ZA(2)/C, ZA(3)/C, ZA(4)/C, ZA(5)/C, ZA(6)/C, ZA(7)/C, ZA(8)/C, B03 590 3690
C   3 60H ZA(3)/C ZA(4)/C ZA(5)/C ZA(6)/C ZA(7)/C ZA(8)/C B03 600 3691
C   4 20H ZA(9)/C ZA(10)/C,/,1X ) B03 610 3692
C 1060 FORMAT( 1X,12F10.4 ) B03 620 3693
C 1070 FORMAT(3X,1HJ,2X,IHK,5X,1HY,9X,2HDY,8X,2HDC,8X,2HDS,/,1X ) B03 630 3694
C 1080 FORMAT(1X,2I3,12(IPE10.3) ) B03 650 3696
C 1090 FORMAT(3X,1HJ,2X,IHK,5X,2HKV,8X,2HYV,8X,2HZV,8X,3H1XV,7X,3H1YV,7X, B03 660 3697
C   * 3H1ZV,7X,2HZN,8X,2HYN,8X,2HZN,8X,3H1KN,7X,3H1YN,7X,3H1ZN,/,1X) B03 670 3698
C 1100 FORMAT( 1X, 2I3, 12(IPE10.3) ) B03 680 3699
C 1100 FORMAT( 1X, 2I3, 12(IPE10.3) ) B03 690 3700
C 1110 FORMAT(5X,1H8,9X,2HCR,8X,2HCT,8X,2HFR,8X,2HET,8X,1HS,9X,2HAR,8X, B03 710 3702
C   * 2HMC,8X,3HMGC,6X,4HMGC,6X,4HXMGC,6X,4HZMGC,/,1X) B03 720 3703
C 1120 FORMAT(1X,12F10.2 ) B03 730 3704
C 1130 FORMAT(1X,/,1X,14H(EOF PLOT FILE,13,1H) ) B03 740 3705
C
C   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXB03 750 3706
C
C   * FILL IN NYS + 1 SPACE *
C   SPAN= 2.0*Y(NYS)
C   WINGD( 1) = SPAN
C   WINGD( 2) = C(1)
C   WINGD( 3) = C(NYS)
C   WINGD( 4) = E(1)
C   WINGD( 5) = E(NYS)
C
C   BUTU= SPAN/2.0
C   DELTF1= WSMOTH
C   DELTF2= WSMOTH
C
C   IF (WSMOTH=1.0) 1140,1150,1150
C 1140 DELTF1= BUTU*DELT1
C   DELTF2= BUTU*DELT2
C 1150 CONTINUE
C
C   YFF11 = YFLAP1
C   YFF21 = YFLAP2
C   YFF31 = YATLRN
C
C   IF (YFLAP2=1.0) 1160,1170,1170
C 1160 YFF11 = YFF1*BUTU
C   YFF21 = YFF2*BUTU
C   YFF31 = YFF3*BUTU
C 1170 YFF11 = YFF1 - 0.5*DELT1
C   YFF21 = YFF2 - C.5*DELT2
C   YFF31 = YFF3 - C.5*DELT2
C
C   YFF12= YFF11 + DELTF1

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YFF22= YFF21 + DELTF2
YFF32 = YFF31 + DELTF2
C
NY1= NYS-1
NY2= NYS+1
Y(NY2)= Y(NYS) + 0.20*(Y(NYS)-Y(NY1))
RAT=(Y(NY2)-Y(NY1))/(Y(NYS)-Y(NY1))
X(NY2)= X(NYS) + RAT*( X(NYS) - X(NY1))
Z(NY2)= Z(NYS) + RAT*( Z(NYS) - Z(NY1))
E(NY2)= E(NYS) + RAT*( E(NYS) - E(NY1))
C(NY2)= C(NYS) + RAT*( C(NYS) - C(NY1))
DO 1180 L=1,NCS
1180 ZOC(L,NY2)= ZOC(L,NYS) + RAT*( ZOC(L,NYS) - ZOC(L,NY1) )
C
L= NCS
L1= L-1
L2= L+1
NCSPL= L2
XOC(L2)= XOC(L) + 0.10*(XOC(L)-XOC(L1))
RAT= ( XOC(L2)-XOC(L) )/( XOC(L)-XOC(L1) )
DO 1190 N=L,NY2
1190 ZOC(L2,N)= ZOC(L,N) + RAT*( ZOC(L,N)-ZOC(L1,N) )
C
C * CALCULATE SPAN FUNCTIONS *
C
NSPV= IFLG(3)
NSPS= NSPV + 1
NDIS= IFLG(2)
IFLAG= IFLG(4)
C
CALL SPANT(IFLAG,NSPS,NDIS,SPAN, YSPAN)
C
DO 1220 L=1,NY2
EY(L)= Y(L)
FLE(L)= X(L) - XCREF*C(L)
ETE(L)= E(L) + C(L)
CF = FLAPC
IF (FLAPC>0.8) 1200,1200,1210
1200 CF = CF*C(L)
1210 ENE(L)= ETE(L) - CF
1220 CONTINUE
C
C * CALCULATE CHORD FUNCTIONS *
C
IFLAG= IFLG(7)
NCV = IFLG(6)
NDIS = IFLG(5)
NOFLPX = NOFLAP + NOAILR
C
IF (NOFLPX) 1240,1240,1230
1230 NCV = NCV -1
NDIS= NDIS-1
1240 CONTINUE
C
CALL CHORDI(IFLAG,NCV,NDIS, XV,XN,XC)
C
DO 1280 J=1,NSPS
C
YF= YSPAN(J)
C
CALL CHORDT(YF,XLE,XCO4,XTE,XHE,CW,CF)
C
IF (NOFLPX) 1260,1260,1250
1250 CW= CW-CF
1260 CONTINUE
C
DO 1270 L=1,NCV
EC(J,L)= XLE + XC(L)*CW
EV(J,L,1)= YF
EV(J,L,2)= XLE + XVL(L)*CW
EV(J,L,3)= 0.0
EN(J,L,1)= XLE + XN(L)*CW
EN(J,L,2)= YF
1270 EN(J,L,3)= 0.0
C
1280 CONTINUE
C
IF (NOFLPX) 1310,1310,1290
1290 CONTINUE
C
NCV= NCV + 1
C
DO 1300 J=1,NSPS
YF= YSPAN(J)
C
CALL CHORDT(YF,XLE,XCO4,XTE,XHE,CW,CF)
C
EV(J,NCV)= YF
EC(J,NCV) = XTE
EV(J,NCV,1)= XHE + 0.25*CF
EV(J,NCV,2)= YF
EV(J,NCV,3)= 0.0
EN(J,NCV,1)= XHE + 0.75*CF
EN(J,NCV,2)= YF
1300 EN(J,NCV,3)= 0.0
C
1310 CONTINUE
C

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      NCVP1 = NCV +1
C      DO 1370 J=1,NSPS
      J2= J+1
      YF= YSPAN(J)
C      CALL CHORDT(YF,XLE,XCD4,XTE,XHE,CW,CF)
C      IF (J-NSPS) 1320,1340,1360
1320 CONTINUE
      DO 1330 K=1,NCV
      1330 EY1J,K)= EY(J2,K)-EY(J,K)
1340 CONTINUE
C      EV1J,NCVP1,1) = XTE
      EV1J,NCVP1,2) = YF
      EV1J,NCVP1,3) = 0.0
      EC1J,NCVP1) = 0.0
C      DO 1350 K=1,NCV
1350 EC1J,K)= EC(J,K)-XLE
      DO 1360 L=2,NCV
      K= NCV +2 -L
      K1= K-1
1360 FC1J,K)= EC(J,K)-EC(J,K1)
C      1370 CONTINUE
C
C      DO 1390 J=1,NSPV
      J2= J+1
      DO 1380 K=1,NCV
      EC1J,K)= 0.5*(EC(J,K)+EC(J2,K))
1380 ES1J,K)= EC(J,K)*EY(J,K)
1390 CONTINUE
C
C      * CALCULATE AIRFOIL SECTION CAMBER *
C      * CALCULATE GEOMETRIC TWIST *
C      DO 1580 J=1,NSPS
C      YF= YSPAN(J)
      YA= ABS(YF)
C
      M= -1
      DO 1420 L=2,NYZ
      IF (M1 1400,1400,1420
1400 TEST= YA - Y(L)
      IF (TEST) 1410,1410,1420
1410 M= L
1420 CONTINUE
      M1= M-1
      IF (M1) 1430,1430,1440
1430 M1= 1
      M= 2
1440 RAT= (YA-Y(M1))/(Y(M1)-Y(1))
C      TANEPS= E(M1) + RAT*( E(M1)-E(M1) )
      TANEPS= TAN(TANEPS/RAD)
      DELTAZ= Z(M1) + RAT*( Z(M)-Z(M1) )
C      DO 1450 L=1,NCSP1
1450 ZOCY(L)= ZOC(L,M1) + RAT*( ZOC(L,M1) - ZOC(L,M1) )
C      CALL CHORDT(YF,XLF,XCD4,XTE,XHE,CW,CF)
C      XROTAT= XLE + XCREF*CW
C
      DO 1560 K=1,NCV
C
      N=-1
      XTEST= EV(J,K,1) - XLE
      DO 1480 L=2,NCSP1
      IF (N1) 1460,1460,1480
1460 TEST= XTEST - XC(L)*CW
      IF (TEST) 1470,1470,1480
1470 N= L
      N1=L-1
1480 CONTINUE
      IF (N1) 1490,1490,1500
1490 N1=1
      N= 2
1500 RATS=(XTEST-CW*XCC(N1))/(XC(N)-XC(N1))
      EV1J,K,3)= DELTAZ + CW*ZOCY(N1) + (ZOCY(N)-ZOCY(N1))*RATS
C
      N=-1
      XTEST= EN1J,K,1) - XLE
      DO 1530 L=2,NCSP1
      IF (N1) 1510,1510,1530
1510 TEST= XTEST - XC(L)*CW
      IF (TEST) 1520,1520,1530
1520 N= L
      N1= L-1
1530 CONTINUE
      IF (N1) 1540,1540,1550
1540 N1= 1
      N= 2
1550 RATS=( XTEST-CW*XCC(N1))/(XC(N)-XC(N1))
      EN1J,K,3)= DELTAZ + CW*ZOCY(N1) + (ZOCY(N)-ZOCY(N1))*RATS
C
      1560 CONTINUE
C

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      DO 1570 K=1,NCV          803 3240      3955
      EVIJ,K,3)=  EVIJ,K,3) + (EV(J,K,1)-XROTAT)*TANEPS 803 3250      3956
1570 EN(J,K,3)=  EN(J,K,3) + (EN(J,K,1)-XROTAT)*TANEPS 803 3260      3957
C
C 1580 CONTINUE
C
C * CALCULATE UNIT VECTORS *
C
      DO 1640 J=1,NSPV        803 3270      3958
      J2= J+1
C
      DO 1630 K=1,NCV        803 3280      3959
C
      SUM1= 0.0                803 3290      3960
      SUM2= 0.0                803 3300      3961
      DO 1590 L=1,3            803 3310      3962
      M= L+3
      EN(J,K,L)=  0.5*( EN(J2,K,L) + EN(J,K,L) )    803 3320      3963
      RAT =  0.5*( EV(J2,K,L) + EV(J,K,L) )    803 3330      3964
      EVIJ,K,M)=  EV(J2,K,L) - EV(J,K,L)    803 3340      3965
      EN(J,K,M)=  RAT - EN(J,K,L)    803 3350      3966
      SUM1= SUM1 + EV(J,K,M)**2    803 3360      3967
1590 SUM2= SUM2 + EN(J,K,M)**2    803 3370      3968
      SUM1= SQRT(SUM1)    803 3380      3969
      SUM2= SQRT(SUM2)    803 3390      3970
      DO 1600 L=1,3            803 3400      3971
      M= L+3
      EV(J,K,M)=  EV(J,K,M)/SUM1    803 3410      3972
      EN(J,K,M)=  EN(J,K,M)/SUM2    803 3420      3973
      COS1(L)=  FN(J,K,M)    803 3430      3974
      1600 COS2(L)=  -EV(J,K,M)    803 3440      3975
C
      CALL CROSP(COS1,COS2,COS3)  803 3450      3976
C
      SUM1= 0.0                803 3460      3977
      DO 1610 L=1,3            803 3470      3978
      M= L+3
      EV(J,K,M)=  EV(J,K,M)/SUM1    803 3480      3979
      EN(J,K,M)=  EN(J,K,M)/SUM2    803 3490      3980
      COS1(L)=  FN(J,K,M)    803 3500      3981
      1610 COS2(L)=  -EV(J,K,M)    803 3510      3982
C
      CALL CROSP(COS1,COS2,COS3)  803 3520      3983
C
      SUM1= 0.0                803 3530      3984
      DO 1620 L=1,3            803 3540      3985
      M= L+3
      EV(J,K,M)=  COS3(L)/SUM1    803 3550      3986
      1620 EN(J,K,M)=  COS3(L)/SUM1    803 3560      3987
C
      1630 CONTINUE
C
      1640 CONTINUE
C
C * WING DATA *
C
C   WINGD( 1) = SPAN
C   WINGD( 2) = ROOT CHORD
C   WINGD( 3) = TIP CHORD
C   WINGD( 4) = ROOT GEOMETRIC TWIST
C   WINGD( 5) = TIP GEOMETRIC TWIST
C   WINGD( 6) = AREA
C   WINGD( 7) = ASPECT RATIO
C   WINGD( 8) = MEAN CHORD
C   WINGD( 9) = MEAN GEOMETRIC CHORD
C   WINGD(10) = SPAN LOCATION OF MEAN GEOMETRIC CHORD
C   WINGD(11) = XMGC, HORIZONTAL MOMENT ARM TO 1/4 CHORD OF MGC
C   WINGD(12) = ZMGC, VERTICAL MOMENT ARM TO 1/4 CHORD OF MGC
C   WINGD(14) = SWEET ANGLE OF 1/4 MGC
C
C
      DO 1570 K=1,NCV          803 3600      3991
      EVIJ,K,3)=  EVIJ,K,3) + (EV(J,K,1)-XROTAT)*TANEPS 803 3610      3992
1570 EN(J,K,3)=  EN(J,K,3) + (EN(J,K,1)-XROTAT)*TANEPS 803 3620      3993
C
C 1580 CONTINUE
C
C * CALCULATE UNIT VECTORS *
C
      DO 1640 J=1,NSPV        803 3630      3994
      J2= J+1
C
      DO 1630 K=1,NCV        803 3640      3995
C
      SUM1= 0.0                803 3650      3996
      DO 1590 L=1,3            803 3660      3997
      M= L+3
      EN(J,K,L)=  0.5*( EN(J2,K,L) + EN(J,K,L) )    803 3670      3998
      RAT =  0.5*( EV(J2,K,L) + EV(J,K,L) )    803 3680      3999
      EVIJ,K,M)=  EV(J2,K,L) - EV(J,K,L)    803 3690      4000
      EN(J,K,M)=  RAT - EN(J,K,L)    803 3700      4001
      1600 COS2(L)=  -EV(J,K,M)    803 3710      4002
C
      CALL CROSP(COS1,COS2,COS3)  803 3720      4003
C
      SUM1= 0.0                803 3730      4004
      DO 1610 L=1,3            803 3740      4005
      M= L+3
      EV(J,K,M)=  EV(J,K,M)/SUM1    803 3750      4006
      EN(J,K,M)=  EN(J,K,M)/SUM2    803 3760      4007
      COS1(L)=  FN(J,K,M)    803 3770      4008
      1610 COS2(L)=  -EV(J,K,M)    803 3780      4009
C
      CALL CROSP(COS1,COS2,COS3)  803 3790      4010
C
      SUM1= 0.0                803 3800      4011
      DO 1620 L=1,3            803 3810      4012
      M= L+3
      EV(J,K,M)=  COS3(L)/SUM1    803 3820      4013
      1620 EN(J,K,M)=  COS3(L)/SUM1    803 3830      4014
C
      1630 CONTINUE
C
      1640 CONTINUE
C
C * WING DATA *
C
C   WINGD( 1) = SPAN
C   WINGD( 2) = ROOT CHORD
C   WINGD( 3) = TIP CHORD
C   WINGD( 4) = ROOT GEOMETRIC TWIST
C   WINGD( 5) = TIP GEOMETRIC TWIST
C   WINGD( 6) = AREA
C   WINGD( 7) = ASPECT RATIO
C   WINGD( 8) = MEAN CHORD
C   WINGD( 9) = MEAN GEOMETRIC CHORD
C   WINGD(10) = SPAN LOCATION OF MEAN GEOMETRIC CHORD
C   WINGD(11) = XMGC, HORIZONTAL MOMENT ARM TO 1/4 CHORD OF MGC
C   WINGD(12) = ZMGC, VERTICAL MOMENT ARM TO 1/4 CHORD OF MGC
C   WINGD(14) = SWEET ANGLE OF 1/4 MGC
C
C
      DO 1570 K=1,NCV          803 3850      4016
      EVIJ,K,3)=  EVIJ,K,3) + (EV(J,K,1)-XROTAT)*TANEPS 803 3860      4017
1570 EN(J,K,3)=  EN(J,K,3) + (EN(J,K,1)-XROTAT)*TANEPS 803 3870      4018
C
C 1580 CONTINUE
C
C * CALCULATE UNIT VECTORS *
C
      DO 1640 J=1,NSPV        803 3880      4019
      J2= J+1
C
      DO 1630 K=1,NCV        803 3890      4020
C
      SUM1= 0.0                803 3900      4021
      DO 1590 L=1,3            803 3910      4022
      M= L+3
      EN(J,K,L)=  0.5*( EN(J2,K,L) + EN(J,K,L) )    803 3920      4023
      RAT =  0.5*( EV(J2,K,L) + EV(J,K,L) )    803 3930      4024
      EVIJ,K,M)=  EV(J2,K,L) - EV(J,K,L)    803 3940      4025
      EN(J,K,M)=  RAT - EN(J,K,L)    803 3950      4026
      1600 COS2(L)=  -EV(J,K,M)    803 3960      4027
C
      CALL CROSP(COS1,COS2,COS3)  803 3970      4028
C
      SUM1= 0.0                803 3980      4029
      DO 1610 L=1,3            803 3990      4030
      M= L+3
      EV(J,K,M)=  EV(J,K,M)/SUM1    803 4000      4031
      EN(J,K,M)=  EN(J,K,M)/SUM2    803 4010      4032
      COS1(L)=  FN(J,K,M)    803 4020      4033
      1610 COS2(L)=  -EV(J,K,M)    803 4030      4034
C
      CALL CROSP(COS1,COS2,COS3)  803 4040      4035
C
      SUM1= 0.0                803 4050      4036
      DO 1620 L=1,3            803 4060      4037
      M= L+3
      EV(J,K,M)=  COS3(L)/SUM1    803 4070      4038
      1620 EN(J,K,M)=  COS3(L)/SUM1    803 4080      4039
C
      1630 CONTINUE
C
      1640 CONTINUE
C
C * WING DATA *
C
C   WINGD( 1) = SPAN
C   WINGD( 2) = ROOT CHORD
C   WINGD( 3) = TIP CHORD
C   WINGD( 4) = ROOT GEOMETRIC TWIST
C   WINGD( 5) = TIP GEOMETRIC TWIST
C   WINGD( 6) = AREA
C   WINGD( 7) = ASPECT RATIO
C   WINGD( 8) = MEAN CHORD
C   WINGD( 9) = MEAN GEOMETRIC CHORD
C   WINGD(10) = SPAN LOCATION OF MEAN GEOMETRIC CHORD
C   WINGD(11) = XMGC, HORIZONTAL MOMENT ARM TO 1/4 CHORD OF MGC
C   WINGD(12) = ZMGC, VERTICAL MOMENT ARM TO 1/4 CHORD OF MGC
C   WINGD(14) = SWEET ANGLE OF 1/4 MGC
C
C
      DO 1570 K=1,NCV          803 4100      4041
      EVIJ,K,3)=  EVIJ,K,3) + (EV(J,K,1)-XROTAT)*TANEPS 803 4110      4042
1570 EN(J,K,3)=  EN(J,K,3) + (EN(J,K,1)-XROTAT)*TANEPS 803 4120      4043
C
C 1580 CONTINUE
C
C * CALCULATE UNIT VECTORS *
C
      DO 1640 J=1,NSPV        803 4130      4044
      J2= J+1
C
      DO 1630 K=1,NCV        803 4140      4045
C
      SUM1= 0.0                803 4150      4046
      DO 1590 L=1,3            803 4160      4047
      M= L+3
      EN(J,K,L)=  0.5*( EN(J2,K,L) + EN(J,K,L) )    803 4170      4048
      RAT =  0.5*( EV(J2,K,L) + EV(J,K,L) )    803 4180      4049
      EVIJ,K,M)=  EV(J2,K,L) - EV(J,K,L)    803 4190      4050
      EN(J,K,M)=  RAT - EN(J,K,L)    803 4200      4051
      1600 COS2(L)=  -EV(J,K,M)    803 4210      4052
C
      CALL CROSP(COS1,COS2,COS3)  803 4220      4053
C
      SUM1= 0.0                803 4230      4054
      DO 1610 L=1,3            803 4240      4055
      M= L+3
      EV(J,K,M)=  EV(J,K,M)/SUM1    803 4250      4056
      EN(J,K,M)=  EN(J,K,M)/SUM2    803 4260      4057
      COS1(L)=  FN(J,K,M)    803 4270      4058
      1610 SUM1= SUM1 + COS3(L)**2    803 4280      4059
C
      SUM1= 0.0                803 4290      4060

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SUM1= SQRT( SUM1 )
DO 1620 L=1,3
M= L+3
1620 EN(J,K,M)= COS3(L)/SUM1
C
1630 CONTINUE
C
1640 CONTINUE
C
C * WING DATA *
C
C WINGD( 1) = SPAN
C WINGD( 2) = ROOT CHORD
C WINGD( 3) = TIP CHORD
C WINGD( 4) = ROOT GEOMETRIC TWIST
C WINGD( 5) = TIP GEOMETRIC TWIST
C WINGD( 6) = AREA
C WINGD( 7) = ASPECT RATIO
C WINGD( 8) = MEAN CHORD
C WINGD( 9) = MEAN GEOMETRIC CHORD
C WINGD(10) = SPAN LOCATION OF MEAN GEOMETRIC CHORD
C WINGD(11) = XMGC, HORIZONTAL MOMENT ARM TO 1/4 CHORD OF MGC
C WINGD(12) = ZMGC, VERTICAL MOMENT ARM TO 1/4 CHORD OF MGC
C WINGD(14) = SWEEP ANGLE OF 1/4 MGC
C WINGD(15) = FLAP CHORD
C
SUM1 = 0.0
SUM6 = 0.0
SUM8 = 0.0
SUM9 = 0.0
SUM10 = 0.0
SUM11 = 0.0
SUM12 = 0.0
C
DSPAN= SPAN/200.0
C
DO 1720 J=1,101
C
JM= J-1
YA2= DSPAN*FLOAT(JM)
C
CALL CHORDT(YA2,XLE,XMGC2,XTE,XHE,CW2,CF)
C
M=-1
DO 1670 L=2,NY2
IF (M) 1650,1650,1670
1650 TEST= YA2-Y(L)-0.0001
IF (TEST) 1660,1660,1670
1660 M=L
M1= L-1
1670 CONTINUE
IF (M1) 1680,1680,1690
1680 M1= 1
M = 2
1690 RAT= (YA2-Y(M1))/(Y(M)-Y(M1))
C
TANEPS= F(M)+I(E(M)-F(M1))*RAT
DELTAZ= Z(M1)+(Z(M)-Z(M1))*RAT
DELTAA= DELTAZ + (XMGC2-XLE-XOCREF*CW21*TANITANEPS/RAD)
C
IF (JM) 1710,1710,1700
C
1700 CW = 0.5*(CW2+C1)
AREA= CW*DSPAN
SUM1 = SUM1 + DSPAN
SUM6 = SUM6 + AREA
SUM8 = SUM8 + AREA
SUM9 = SUM9 + AREA*CW
SUM10 = SUM10 + AREA*(YA2+YA1)*0.5
SUM11 = SUM11 + AREA*(XMGC2+XMGC1)*0.5
SUM12 = SUM12 + AREA*(DELTAA+DELTAA)*0.5
C
1710 DELTAA= DELTAZ
XMGC1= XMGC2
CW1 = CW2
YA1 = YA2
C
1720 CONTINUE
C
ZERO = 0.0
C
CALL CHOPDT(ZERO,XLE,XC04,XTE,XHE,CW,CF)
C
XROOT= XC04
ZROOT= Z(1)
C
WINGD( 1) = SUM1*2.0
WINGD( 6) = SUM6*2.0
WINGD( 7) = 2.0*(SUM1**21/SUM6
WINGD( 8) = SUM8/SUM1
WINGD( 9) = SUM9/SUM6
WINGD(10) = SUM10/SUM6
WINGD(11) = SUM11/SUM6
WINGD(12) = SUM12/SUM6
WINGD(13) = RAD*ATAN((WINGD(12)- ZROOT)/WINGD(10))
WINGD(14) = RAD*ATAN((WINGD(11)- XROOT)/WINGD(10))
WINGD(15) = FLAPC
C
C CALL PAGE
WRITE (KJUT,1010)(WINGD(I),I=1,12),YFLAP1,YFLAP2,FLAPC,YFLAP2,BOTU
1,FLAPC,WINGD(13),WINGD(14),IFLG(3),IFLG(2),IFLG(6),IFLG(5)      803 5340
1,FLAPC,WINGD(13),WINGD(14),IFLG(3),IFLG(2),IFLG(6),IFLG(5)      803 5350

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ORIGINAL PAGE IS  
OF POOR QUALITY

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      LINES= LINES + 15          B03 5360    4167
C      WRITE (KOUT,1030)          B03 5370    4168
C      LINES= LINES +3          B03 5380    4169
C      DO 1820 J=1,NSPS          B03 5390    4170
C
C      YF= YSPAN(JI)
C      YA= ABS(YF)
C      YOB= YF/ROTU
C
C      CALL CHORDT(YF,XLE,XCO4,XTE,XHE,CW,CF)
C
C      M= -1
C      DO 1750 L=2,NY2
C      IF (M) 1730,1730,1750
C      1730 TEST= YA - Y(L) - 0.0001
C      IF (TEST) 1740,1740,1750
C      1740 M= L
C      M1= M-1
C      1750 CONTINUE
C      IF (M1) 1760,1760,1770
C      1760 M= 2
C      M1= 1
C      1770 RAT= (YA-Y(M1))/(Y(M)-Y(M1))
C
C      ZY= Z(M1) + RAT*( Z(M) - Z(M1) )
C      EK= E(M1) + RAT*( E(M) - E(M1) )
C
C      IF (J-1) 1780,1780,1790
C      1780 YF1= YF - 0.05*SPAN/FLOAT(NSPV)
C      YA= ABS(YF1)
C
C      CALL CHORDT(YA,XLE1,XCO41,XTE1,XHE1,CW1,CF1)
C      ZY1 = Z(M1) + (Z(M)-Z(M1))*(YA-Y(M1))/(Y(M)-Y(M1))
C
C      1790 DELTA1= YF-YF1
C
C      BETA= RAD*ATAN( (XCO4-XCO41)/DELTA1)
C      DIHE= RAD*ATAN( (ZY-ZY1)/DELTA1 )
C
C      IF (LINEX-LINES) 1800,1810,1810
C      1800 CALL PAGE
C      WRITE (KOUT,1030)
C      LINES= LINES+2
C      1810 WRITE (KOUT,1040)YOB,YF,XLE,XCO4,XHE,XTE,ZY,EK,BETA,DIHE,CW,CF
C
C      LINES= LINES + 1
C      YF1= YF
C      ZY1= ZY
C      XCO41= XCO4
C      1820 CONTINUE
C
C      WRITE (KOUT,1000)
C      LINES= LINES +3
C      LINES= LINES +7
C      IF (LINEX-LINES) 1830,1840,1840
C      1830 CALL PAGE
C      LINES= LINES +7
C      1840 WRITE (KOUT,1050)(XOC(I),I=1,10)
C      LINES= LINES +1
C
C      DO 1870 J=1,NYS
C      IF (LINEX-LINES) 1850,1860,1860
C      1850 CALL PAGE
C      WRITE (KOUT,1050)
C      LINES= LINES+7
C      1860 CONTINUE
C      YOB= Y(JI)/ROTU
C      WRITE (KOUT,1060)Y(JI),YOB,(ZOC(I,JI),I=1,NCS)
C      LINES= LINES + 1
C      1870 CONTINUE
C
C      LINES= LINES+3
C      IF (LINEX-LINES) 1880,1890,1890
C      1880 CALL PAGE
C      LINES= LINES +3
C      1890 WRITE (KOUT,1000)
C
C      * DEBUG OUTPUT *
C
C      IF (IFLG(10)) 2030,1900,1900
C      1900 IFLG(10)= IFLG(10)-1
C
C      LINES= LINES+2
C      IF (LINEX-LINES) 1910,1920,1920
C      1910 CALL PAGE
C      LINES= LINES+2
C      1920 WRITE (KOUT,1070)
C
C      DO 1950 K=1,NCV
C      LINES= LINES+1
C      DO 1940 J=1,NSPV
C      LINES= LINES+1
C      IF (LINEX-LINES) 1930,1940,1940
C      1930 CALL PAGE
C      WRITE (KOUT,1070)
C      LINES= LINES + 2+1
C      1940 WRITE (KOUT,1080)J,K,EN(J,K,2),EY(J,K1),EC(J,K1),ES(J,K)
C      1950 WRITE (KOUT,1020)
C
C
B03 5360    4167
B03 5370    4168
B03 5380    4169
B03 5390    4170
B03 5400    4171
B03 5410    4172
B03 5420    4173
B03 5430    4174
B03 5440    4175
B03 5450    4176
B03 5460    4177
B03 5470    4178
B03 5480    4179
B03 5490    4180
B03 5500    4181
B03 5510    4182
B03 5520    4183
B03 5530    4184
B03 5540    4185
B03 5550    4186
B03 5560    4187
B03 5570    4188
B03 5580    4189
B03 5590    4190
B03 5600    4191
B03 5610    4192
B03 5620    4193
B03 5630    4194
B03 5640    4195
B03 5650    4196
B03 5660    4197
B03 5670    4198
B03 5680    4199
B03 5690    4200
B03 5700    4201
B03 5710    4202
B03 5720    4203
B03 5730    4204
B03 5740    4205
B03 5750    4206
B03 5760    4207
B03 5770    4208
B03 5780    4209
B03 5790    4210
B03 5800    4211
B03 5810    4212
B03 5820    4213
B03 5830    4214
B03 5840    4215
B03 5850    4216
B03 5860    4217
B03 5870    4218
B03 5880    4219
B03 5890    4220
B03 5900    4221
B03 5910    4222
B03 5920    4223
B03 5930    4224
B03 5940    4225
B03 5950    4226
B03 5960    4227
B03 5970    4228
B03 5980    4229
B03 5990    4230
B03 6000    4231
B03 6010    4232
B03 6020    4233
B03 6030    4234
B03 6040    4235
B03 6050    4236
B03 6060    4237
B03 6070    4238
B03 6080    4239
B03 6090    4240
B03 6100    4241
B03 6110    4242
B03 6120    4243
B03 6130    4244
B03 6140    4245
B03 6150    4246
B03 6160    4247
B03 6170    4248
B03 6180    4249
B03 6190    4250
B03 6200    4251
B03 6210    4252
B03 6220    4253
B03 6230    4254
B03 6240    4255
B03 6250    4256
B03 6260    4257
B03 6270    4258
B03 6280    4259
B03 6290    4260
B03 6300    4261
B03 6310    4262
B03 6320    4263
B03 6330    4264
B03 6340    4265
B03 6350    4266
B03 6360    4267
B03 6370    4268
B03 6380    4269
B03 6390    4270
B03 6400    4271
B03 6410    4272

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LINES= LINES+3
IF (LINEX-LINES) 1960,1970,1970
1960 CALL PAGE
LINES= LINES+3
1970 WRITE (KOUT,1000)
C
IF (LINEX-LINES) 1980,1990,1990
1980 CALL PAGE
LINES= LINES + 2
1990 WRITE (KOUT,1090)
C
DO 2020 K=1,NCV
LINES= LINES+1
DO 2010 J=1,NSPV
LINES= LINES+1
IF (LINEX-LINES) 2000,2010,2010
2000 CALL PAGE
WRITE (KOUT,1090)
LINES= LINES + 2
2010 WRITE (KOUT,1100)J,K,(EV(J,K,I),I=1,6),(EN(J,K,I),I=1,6)
2020 WRITE (KOUT,1020)
C
2030 CONTINUE
C
LINES= LINES+3
IF (LINEX-LINES) 2040,2050,2050
2040 CALL PAGE
LINES= LINES+3
2050 WRITE (KOUT,1000)
C
C * WRITE ON CALCOMPLOT TAPE *
C
IF (IFLG(12)-1) 2460,2060,2060
2060 IREC1=1
IREC2=7
XZERO = X(1) - D.4*BOTU
ZZERO = Z(1)
C
DO 2070 J=1,NSPS
YSPN = YSPAN(J)
C
CALL CHORDT(YSPN,XLE,XC04,XTE,XHE,CW,CF)
C
YSPN = YSPN/BOTU
XLE = (XLE - XZERO)/BOTU
XC04= (XC04 - XZERO)/BOTU
XTE = (XTE - XZERO)/BOTU
XHE = (XHE - XZERO)/BOTU
CW = CW/BOTU
CF = CF/BOTU
2070 WRITE(KT2)IREC1,IREC2,YSPN,XLE,XC04,XTE,XHE,CW,CF
C
C
IREC1= 2
IREC2= 2
K=1
DO 2100 J=1,NSPS
YSPN = EV(J,K,2)
C
CALL CHORDT(YSPN,XLE,XC04,XTE,XHE,CW,CF)
C
YSPN = YSPN/BOTU
XLE = (XLE - XZERO)/BOTU
XTE = (XTE - XZERO)/BOTU
IF (ITET) 2080,2180,2090
2080 ITET = 1
WRITE(KT2)IREC1,IREC2,YSPN,XLE
WRITE(KT2)IREC1,IREC2,YSPN,XTE
GU TO 2100
2090 ITET = -1
WRITE(KT2)IREC1,IREC2,YSPN,XTE
WRITE(KT2)IREC1,IREC2,YSPN,XLE
2100 CONTINU
C
C
IREC1= 3
IREC2= 2
ITET ==1
DO 2150 K=1,NCV
DO 2140 J=1,NSPS
IF (ITET) 2110,2110,2120
2110 JR = J
GJ TO 2130
2120 JR = NSPS +1-J
2130 CONTINUE
YSPN = ( EV(JR,K,2) )/BOTU
XLE = (EV(JR,K,1) -0.25*EC(JR,K) -KZERO)/BOTU
2140 WRITE(KT2)IREC1,IREC2,YSPN,XLE
ITET = -1*ITET
2150 CONTINU
C
C
IREC1=4
IREC2=3
C
DO 2210 J=1,NSPS
C
YSPN= EV(J,1,2)
YA= ABS(YSPN)
M=-1
DO 2180 K=1,NY2
IF (M) 2160,2180,2180
2160 TEST= YA-Y(K)
IF (TEST) 2170,2170,2180
2170 M= K

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2180 CONTINUE
C
M1=M-1
IF (M1) 2190,219C,2200
2190 M=2
M1=1
2200 RAT= ( YA      -Y(M1))/(Y(M)-Y(M1))
C
CALL CHORDT(YSPN,XLE,XCO4,XTE,XHE,CW,CF)
C
DELTAZ= Z(M1) + (Z(M)-Z(M1))*RAT
TANEPS= E(M1) + (E(M)-E(M1))*RAT/RAD
TANEPS= TAN(TANEPS)
ZLE= (-DELTAZ + TANEPS*CW*(XOCREF)) //BOTU
ZTE= (-DELTAZ + TANEPS*CW*(XOCREF-1.0)) //BOTU
YSPN= YSPN/BOTU
2210 WRITE(KT2)IRECL,IREC2,YSPN,ZLE,ZTE
C
C
IREC1= 5
IREC2= 6
ZERO = D.0
XZERO= X(1) + C(1)*(0.5-XOCREF)
YZERO= Y(1)
ZZERO= Z(1)
PHIR= 45.0/RAD
PHIP = -PHIR
PHIQ = 0.5*PHIP
C
C
DO 2270 J=1,NSPS
C
YSPN = YSPAN(J)
YA = ABS(YSPN)
C
CALL CHORDT(YSPN,XLE,XCO4,XTE,XHE,CW,CF)
C
M=-1
DO 2240 K=1,NYS
IF (M) 2220,2240,2240
2220 TEST= YA-Y(K)-0.0001
IF (TEST) 2230,2230,2240
2230 M=K
2240 CONTINUE
IF (M-1) 2250,2250,2260
2250 M= 2
2260 M1= M-1
C
RAT= (YA-Y(M1))/(Y(M)-Y(M1))
DELTAZ= Z(M1) + (Z(M)-Z(M1))*RAT
TANEPS= E(M1) + (E(M)-E(M1))*RAT
TANEPS= TAN(TANEPS/RAD)
C
ZLE = (-DELTAZ + TANEPS*CW*(XOCREF) + ZZERO) //BOTU
YLE = YSPN/BOTU
XLE = (XLE - XZERO)/BOTU
ZTE = (-DELTAZ + TANEPS*CW*(XOCREF-1.0)+ ZZERO) //BOTU
YTE = YLE
XTE = (XTE - XZERO)/BOTU
C
CALL ROTATE(XLE,ZLE, ZER0,ZER0, PHIR, ZERO,ZER0, XLE,ZLE )
CALL ROTATE(YLE,XLE, ZER0,ZER0, PHIP, ZERO,ZER0, YLE,XLE )
CALL ROTATE(YLE,ZLE, ZER0,ZER0, PHIQ, ZERO,ZER0, YLE,ZLE )
CALL ROTATE(XTE,ZTE, ZER0,ZER0, PHIR, ZERO,ZER0, XTE,ZTE )
CALL ROTATE(YTE,XTE, ZER0,ZER0, PHIP, ZERO,ZER0, YTE,XTE )
CALL ROTATE(YTE,ZTE, ZER0,ZER0, PHIQ, ZERO,ZER0, YTE,ZTE )
C
2270 WRITE(KT2)IREC1,IREC2,YLE,ZTE,XLE,XTE
C
C
IREC1= 6
IREC2= 3
I=1
C
DO 2350 J=1,NSPS
C
YSPN = EV(J,I,2)
YA = ABS(YSPN)
C
CALL CHORDT(YSPN,XLE,XCO4,XTE,XHE,CW,CF)
C
M= -1
DO 2300 K=1,NYS
IF (M) 2280,2300,2300
2280 TEST= YA-Y(K)-0.0001
IF (TEST) 2290,2290,2300
2290 M= K
2300 CONTINUE
IF (M-1) 2310,2310,2320
2310 M= 2
2320 M1= M-1
C
RAT= (YA-Y(M1))/(Y(M)-Y(M1))
DELTAZ= Z(M1) + (Z(M)-Z(M1))*RAT
TANEPS= E(M1) + (E(M)-E(M1))*RAT
TANEPS= TAN(TANEPS/RAD)
C
ZLE = (-DELTAZ + TANEPS*CW*(XOCREF) + ZZERO) //BOTU
YLE = YSPN/BOTU
XLE = (XLE - XZERO) //BOTU
ZTE = (-DELTAZ + TANEPS*CW*(XOCREF-1.0) + ZZERO) //BOTU
YTE = YLE
XTE = (XTE - XZERO) //BOTU
C
CALL ROTATE(XLE,ZLE, ZER0,ZER0, PHIR, ZERO,ZER0, XLE,ZLE )
CALL ROTATE(YLE,XLE, ZER0,ZER0, PHIP, ZERO,ZER0, YLE,XLE )

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CALL ROTATE( YLE,ZLE, ZERC,ZERO, PHIQ, ZERO,ZERO, YLE,ZLF ) 803 8540 4485
CALL ROTATE( XTE,ZTE, ZERC,ZERO, PHIR, ZERO,ZERO, XTE,ZTE ) 803 8550 4486
CALL ROTATE( YTE,XTE, ZERC,ZERO, PHIP, ZERO,ZERO, YTE,XTE ) 803 8560 4487
CALL ROTATE( YTE,ZTE, ZERC,ZERO, PHIQ, ZERO,ZERO, YTE,ZTE ) 803 8570 4488
C
IF ( ITET1) 2330,2230,2340
2330 ITET = 1
      WRITE(KT2)IREC1,IREC2,YLE,ZLE,XLE
      WRITE(KT2)IREC1,IREC2,YTE,ZTE,XTE
      GO TO 2350
2340 ITET = -1
      WRITE(KT2)IREC1,IREC2,YTE,ZTE,XTE
      WRITE(KT2)IREC1,IREC2,YLE,ZLE,XLE
C
2350 CONTINUE
C
      IREC1= 7
      IREC2= 3
      ITET = -1
C
      DO 2450 I=1,NCVPL
      DO 2440 J=1,NSPS
C
      IF ( [ITET] ) 2360,2360,2370
2360 JR= J
      GO TO 2380
2370 JR= NSPS +1-J
2380 CONTINUE
C
      YSPN= EV(JR,I,2)
      YA = ABS(YSPN)
C
      CALL CHORDT(YSPN,XLE,XC04,XTE,XHE,CW,CF)
C
      M= -1
      DO 2410 K=1,NYS
      IF ( M) 2390,2410,2410
2390 TEST= YA -Y(K)-0.0001
      IF ( TEST) 2400,2410,2410
2400 M= K
2410 CONTINUE
      IF ( M-1) 2420,2420,2430
2420 M= 2
2430 M1= M-1
C
      RAT= (YA-Y(M1))/(Y(M)-Y(M1))
      DELTAZ= Z(M1) + ( Z(M)-Z(M1) )*RAT
      TANEPS= E(M1) + ( E(M)-E(M1) )*RAT
      TANEPS= TAN(TANEPS/RAD)
C
      XTE = XLF
      XLE = EV(JR,I,1) -0.25*EC(JR,I)
      YLE = YSPN/BOTU
      ZLE = (-DELTAZ + TANEPS*( XTE + CW*X0CREF - XLE ) + ZZERO )/BOTU
      XLE = (XLE-XZERO)/BOTU
C
      CALL ROTATE( XLE,ZLE, ZFC,ZERO, PHIR, ZERO,ZERO, XLE,ZLE ) 803 9110 4542
      CALL ROTATE( YLE,XLE, ZERO,ZERO, PHIP, ZERO,ZERO, YLE,XLE ) 803 9120 4543
      CALL ROTATE( YLE,ZLE, ZERC,ZERO, PHIQ, ZERO,ZERO, YLE,ZLE ) 803 9130 4544
C
2440 WRITE(KT2)IREC1,IREC2,YLE,ZLF,XLE
C
      ITET= -1*ITET
C
2450 CONTINUE
C
END FILE KT2
IFLG(15)= IFLG(15) +1
LINES= LINES +2
WRITE( KOUT,1130)IFLG(15)
C
C
2460 CONTINUE
C
      RETURN
C
XXXXXX
C
END

    FDR 804,804          804   10  4567
C
C
C
SUBROUTINE DLIFT(ALFA,ZHETGT)
C
* TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *804 70 4573
* PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *804 80 4574
C
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX804 100 4575
C
DOURLF PRECISION SCALE,SUP,DETERM,AMAT(TL,T1),VMAT(T1)
DIMENSION P1(3),B(3),D(3)
DIMENSION COS1(3),COS2(3),COS3(3)
DIMENSION SUMWL(4),SUMSL(4)
DIMENSION PW(3),BW(3),DW(3)
C
COMMON/DATA01/KIN ,KOUT ,KT1 ,KT2 ,LINEX ,LINES
C
COMMON/DATA02/IFLG(15) ,EXECK(15) ,RAD ,PIE
C

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COMMON/DATA05/WINGD(15)    ,EY(42,10)    ,EC(42,10)    ,ES(42,10) 804 220      4588
*,EYE(10)     ,ELE(10)     ,ETE(10)     ,EHE(10)     ,EG(42,10) 804 230      4589
*,EN(42,10,6) ,EV(42,10,6) ,VVINDK(42,10,3)          804 240      4590
C
C
1000 FORMAT(1X)
1010 FORMAT(1X,/,1X)
C
1020 FORMAT(47X,28HVORTEX LATTICE MATRIX DETAIL,/,47X,28(1H*),/,1X) 804 300      4596
1030 FORMAT(  IX,I2H J K NP NG,
2 60H VFSIMAT)  VIN(MAT)   P(X)      P(Y)      P(Z)      B(X)      , 804 310      4597
3 50H B(Y)      B(Z)      D(X)      D(Y)      D(Z)      ,/,1X) 804 320      4598
1040 FORMAT(1X,4I3,1I1E10.4)          804 330      4599
C
1050 FORMAT(48X,24HLIFT DISTRIBUTION DETAIL,/,48X,24(1H*),/,1X) 804 340      4600
1060 FORMAT(3X,4HJ K,5X,40HPI(X)   PI(Y)   PI(Z)   AREA   ,
160HCPN   G(X)   G(Y)   G(Z)   VI(X)   VI(Y)   , 804 350      4601
215HVI(Z)   GAMMA   ,/,1X) 804 360      4602
1070 FORMAT(  IX, 2I3, 3F10.3, 2F10.4, 6F10.5, E10.4 ) 804 370      4603
C
1080 FORMAT(48X,24HSECTION LIFT COEFFICIENTS,/,48X,24(1H*),/,1X) 804 380      4604
1090 FORMAT( 8X,3H J,99H 2Y/B Y C SCL SCLB04 430      4605
1C/B DLIFT SCMC(4) 1XL LYL 1ZL ,/,1X) 804 390      4606
1100 FORMAT( 8X,13,F10.4,2F10.3,7F10.4) 804 400      4607
C
1110 FORMAT(//,47X,25HWING AIRLOAD COEFFICIENTS,/,47X,25(1H*),/,18X,804 410      4608
2 60H WCL WCDI WCMR WCMY IKL   , 804 420      4609
3 40H 1YL 1ZL DELTA SCALE //, 804 430      4610
4 3X,15HWITH LE SUCTION, SF10.5*3F10.6, ZE10.4,/, 804 440      4611
5 3X,15H NO LE SUCTION, SF10.5*3F10.6,/,1X ) 804 450      4612
C
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 804 460      4613
C
C * INITIALIZE *
C
NSPV = IFLG(3)          804 470      4614
NCV = IFLG(6)           804 480      4615
SPAN = WINGD(1)         804 490      4616
WAREA= WINGD(6)        804 500      4617
WNCG = WINGD(9)         804 510      4618
BOTU= SPAN/2.0          804 520      4619
C
ALFAR= ALFA/RAD         804 530      4620
TANA = TAN(ALFAR)       804 540      4621
COSA = 1.0/SQRT(1.0+TANA**2) 804 550      4622
SINA = TANA*COSA        804 560      4623
TANV= -TAN(0.5*ALFAR)   804 570      4624
TANVG= -TAN(1.5*ALFAR)  804 580      4625
UNIT = 0.25/PIE          804 590      4626
UNITG= -UNIT             804 600      4627
C
C * SYMMETRIC OR UNSYMMETRIC TEST *
C
NZERO= 1                804 610      4628
IF (IFLG(1)=1) 1120,1130,1130
1120 CONTINUE
NSP02= NSPV/2
NTEST= NSPV-NSP02*2
NZERO= NSP02 + 1
1130 CONTINUE
C
C * CALCULATE MATRICES VMAT(NV) & AMAT(NG,NV) *
C
NV= 0
NM= 0
DO 1420 KV=1,NCV
DO 1390 JV=NZERO,NSPV
NV= NV+1
C
COS1(1)= COSA
COS1(2)= 0.0
COS1(3)= -SINA
YSPN= EN(JV,KV,2)
C
CALL CHORDT(YSPN,XLE,XC04,XTE,XHE,CW,CF)
C
DO 1140 L=1,3
M= L+3
COS2(L)= EN(JV,KV,M)
1140 P(L)= EN(JV,KV,L)
C
CALL FLAPS(YSPN,XHE, P,COS2)
C
CALL DOTP(COS1,CCS2,VMATDP)
C
VMAT(NV)= VMATDP
C
DO 1150 L=1,3
1150 COS1(L)= COS2(L)
C
NG= 0
DO 1380 KG=1,NCV
DO 1370 JG=NZERO,NSPV
NG= NG+1
C
I= JG+1
DO 1160 L=1,3
B(L)= EV(JG,KG,L)
804 620      4629
804 630      4630
804 640      4631
804 650      4632
804 660      4633
804 670      4634
804 680      4635
804 690      4636
804 700      4637
804 710      4638
804 720      4639
804 730      4640
804 740      4641
804 750      4642
804 760      4643
804 770      4644
804 780      4645
804 790      4646
804 800      4647
804 810      4648
804 820      4649
804 830      4650
804 840      4651
804 850      4652
804 860      4653
804 870      4654
804 880      4655
804 890      4656
804 900      4657
804 910      4658
804 920      4659
804 930      4660
804 940      4661
804 950      4662
804 960      4663
804 970      4664
804 980      4665
804 990      4666
804 1000     4667
804 1010     4668
804 1020     4669
804 1030     4670
804 1040     4671
804 1050     4672
804 1060     4673
804 1070     4674
804 1080     4675
804 1090     4676
804 1100     4677
804 1110     4678
804 1120     4679
804 1130     4680
804 1140     4681
804 1150     4682
804 1160     4683
804 1170     4684
804 1180     4685
804 1190     4686
804 1200     4687
804 1210     4688
804 1220     4689
804 1230     4690
804 1240     4691
804 1250     4692
804 1260     4693
804 1270     4694

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1160 D(L)= EV( I,KG,L)
C
      YSPN= B(2)
      CALL CHORDT( YSPN,XLE,XCO4,XTE,XHE,CW,CF )
      CALL FLAPS( YSPN,XHE,B,COS2 )
      YSPN= D(2)
C
      CALL CHORDT( YSPN,XLE,XCO4,XTE,XHE,CW,CF )
      CALL FLAPS( YSPN,XHE,D,COS2 )
      DD 1170 L=1,3
      PW(L)= P(L)
      BW(L)= B(L)
      1170 DW(L)= D(L)
C
      CALL VORTEX(P,B,D,TANV,UNIT, VI,COS2)
      CALL DOTP(COS1,CCS2,SUM1)
C
      SUM1= SUM1*VI
      SUM2= 0.0
C
      IF (IFLG(9)-1) 1190,1180,1180
1180 CONTINUE
      CALL REFLEC(B,ZHEIGHT,ALFAR,COSA)
      CALL REFLEC(D,ZHEIGHT,ALFAR,COSA)
C
      CALL VORTEX(P,B,D,TANV,UNITG, VI,COS2)
      CALL DOTP(COS1,CCS2,SUM3)
C
      SUM1= SUM1 + SUM3*VI
1190 CONTINUE
C
      IF (IFLG(1)-1) 1200,1250,1250
1200 JGM= NSPV-JG+1
      IF (JGM-JG) 1210,1250,1250
      DD 1420 KV=1,NCV
      DD 1390 JV=NZERO,NSPV
      NV= NV+1
C
      COS1(1)= COSA
      COS1(2)= 0.0
      COS1(3)= -SINA
      YSPN= EN(JV,KV,2)
C
      CALL CHORDT( YSPN,XLE,XCO4,XTE,XHE,CW,CF )
C
      DD 1140 L=1,3
      M= L+3
      COS2(L)= EN(JV,KV,M)
1140 P(L)= EN(JV,KV,L)
C
      CALL FLAPS( YSPN,XHE, P,COS2)
C
      CALL DOTP(COS1,COS2,VMATDP)
C
      VMAT(NV)= VMATDP
C
      DD 1150 L=1,3
1150 COS1(L)= COS2(L)
C
      NG= 0
      DD 1380 KG=1,NCV
      DD 1370 JG=NZERO,NSPV
      NG= NG+1
C
      I= JG+1
      DD 1160 L=1,3
      B(L)= EV(JG,KG,L)
1160 D(L)= EV( I,KG,L)
C
      YSPN= B(2)
      CALL CHORDT( YSPN,XLE,XCO4,XTE,XHE,CW,CF )
      CALL FLAPS( YSPN,XHE,B,COS2 )
      YSPN= D(2)
      CALL CHORDT( YSPN,XLE,XCO4,XTE,XHE,CW,CF )
      CALL FLAPS( YSPN,XHE,D,COS2 )
      DD 1170 L=1,3
      PW(L)= P(L)
      BW(L)= B(L)
      1170 DW(L)= D(L)
C
      CALL VORTEX(P,B,D,TANV,UNIT, VI,COS2)
      CALL DOTP(COS1,CCS2,SUM1)
C
      SUM1= SUM1*VI
      SUM2= 0.0
C
      IF (IFLG(9)-1) 1190,1180,1180
1180 CONTINUE
      CALL REFLEC(B,ZHEIGHT,ALFAR,COSA)
      CALL REFLEC(D,ZHEIGHT,ALFAR,COSA)
C
      CALL VORTEX(P,B,D,TANV,UNITG, VI,COS2)
      CALL DOTP(COS1,CCS2,SUM3)
C
      SUM1= SUM1 + SUM3*VI
1190 CONTINUE
C
      IF (IFLG(1)-1) 1200,1250,1250
1200 JGM= NSPV-JG+1
      IF (JGM-JG) 1210,1250,1250
1210 CONTINUE
      I= JGM+1
      DD 1220 L=1,3
      B(L)= EV(JGM,KG,L)

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```

1220 DFLI = EVE(I,KG,L)
C
      YSPN= B(2)
      CALL CHORDT4 YSPN,XLE,XCD4,XTE,XHE,CW,CF
      CALL FLAPS( YSPN,XHE,B,COS2 )
      YSPN= D(2)
      CALL CHORDT4 YSPN,XLE,XCD4,XTE,XHE,CW,CF
      CALL FLAPS( YSPN,XHE,D,COS2 )
C
      CALL VORTEXIP,B,D,TANV,UNIT,V1,COS2)
      CALL DOTP(COS1,COS2,SUM2)
C
      SUM2= SUM2*VI
C
      IF (IFLG(9)-1) 1240,1230,1230
1230 CONTINUE
      CALL REFLEC(B,ZHEIGHT,ALFAR,COSA)
      CALL REFLEC(D,ZHEIGHT,ALFAR,COSA)
C
      CALL VORTEXIP,B,D,TANVG,UNITG,V1,COS2)
      CALL DOTP(COS1,CCS2,SUM4)
C
      SUM2= SUM2 + SUM4*VI
1240 CONTINUE
C
1250 CONTINUE
C
      AMAT(NG,NV)= SUM1+SUM2
C
      IF (EXECK(15)-1.C) 1260,1360,1360
1260 IF (IFLG(10)-5) 1360,1270,1270
1270 IF (NM-1) 1280,1280,1340
1280 LINES= LINES+4
      NM= 10
      IF (LINEX-LINES) 1290,1300,1300
1290 CALL PAGE
      LINES= LINES+4
1300 WRITE (KOUT,1020)
1310 LINES=LINES+2
      IF (LINEX-LINES) 1320,1330,1330
1320 CALL PAGE
      LINES= LINES+2
1330 WRITE (KOUT,1030)
1340 LINES=LINES+1
      IF (LINEX-LINES) 1320,1350,1350
1350 WRITE (KOUT,1040) JV,KV,NV,NG,VMAT(NV),AMAT(NG,NV),(PW(I),I=1,3),
     1W(I),I=1,3),(DW(I),I=1,3)
1360 CONTINUE
C
C
1370 CONTINUE
1380 CONTINUE
C
1390 CONTINUE
C
      IF (EXECK(15)-1.C) 1400,1420,1420
1400 IF (IFLG(10)-5) 1420,1410,1410
1410 WRITE (KOUT,1000)
      LINES=LINES+1
C
1420 CONTINUE
C
C
      LINES= LINES+3
      IF (LINEX-LINES) 1430,1440,1440
1430 CALL PAGE
      GO TO 1450
1440 WRITE (KOUT,1010)
1450 CONTINUE
C
C
      * SOLVE FOR GAMA *
C
C
      NM= 0
      SUP= 0.0
      DO 1470 J=1,NV
      DO 1460 K=1,NG
      NM= NM+1
1460 SUP= SUP + DABS( AMAT(K,J) )
1470 CONTINUE
      SCALE = FLOAT(NM)
      SCALE = SUP/SCALE
      DO 1490 J=1,NV
      DO 1480 K=1,NG
1480 AMAT(J,K)= AMAT(J,K)/SCALE
1490 CONTINUE
C
      CALL DMATIN(AMAT,NV,DETERM)
C
      NG= 0
      DO 1530 K=1,NCV
      DO 1520 J=NZERO,NSPV
      NG=NG+1
C
      SUP= 0.0
      NV= 0
      DO 1510 KV=1,NCV
      DO 1500 JV=NZERO,NSPV
      NV=NV+1
1500 SUP= SUP - VMAT(NV)*AMAT(NV,NG)
1510 CONTINUE

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C      SUP = SUP/SCALE
C      SUM = -SUP
1520 EG(J,K)= SUM/EXECK(1)
1530 CONTINUE
C
C
C      IF (IFLG(1)-1) 1540,1570,1570
1540 CONTINUE
DO 1560 J=NZERO,NSPV
JM= NSPV+1-J
DO 1550 K=1,NCV
1550 EG(JM,K) = FG(J,K)
1560 CONTINUE
1570 CONTINUE
C
C
C      * SOLVE FOR INDUCED VELOCITY MATRIX *
C
DO 1700 K=1,NCV
DO 1690 J=NZERO,NSPV
C
I = J+1
DO 1580 L=1,3
SUMSL(L)= 0.0
B(L)= EV(J,K,L)
1580 D(L)= EV(I,K,L)
YSPN= B(2)
CALL CHORDT(YSPN,XLE,XCO4,XTE,XHE,CW,CF)
CALL FLAPS( YSPN,XHE,B,COS3)
YSPN= D(2)
CALL CHORDT(YSPN,XLE,XCO4,XTE,XHE,CW,CF)
CALL FLAPS( YSPN,XHE,D,COS3)
DO 1590 L=1,3
1590 P(L)= 0.5*( B(L)+D(L) )
C
DO 1660 KG=1,NCV
DO 1650 JG=1,NSPV
C
I = JG+1
DO 1640 L=1,3
B(L)= EV(JG,KG,L)
1640 D(L)= EV(I,KG,L)
YSPN= B(2)
CALL CHORDT(YSPN,XLE,XCO4,XTE,XHE,CW,CF)
CALL FLAPS( YSPN,XHE,B,COS2 )
YSPN= D(2)
CALL CHORDT(YSPN,XLE,XCO4,XTE,XHE,CW,CF)
CALL FLAPS( YSPN,XHE,D,COS2 )
C
CALL VORTEX(P,B,D,TANV,UNIT,VI,COS2)
C
DO 1610 L=1,3
1610 SUMSL(L)= SUMSL(L) - EG(JG,KG)*VI*COS2(L)
C
IF (IFLG(9)-1) 1640,1620,1620
1620 CALL REFLEC(B,ZHEIGT,ALFAR,COSA)
CALL REFLEC(D,ZHEIGT,ALFAR,COSA)
C
CALL VORTEX(P+B,D,TANVG,UNIT,G,VI,COS2)
C
DO 1630 L=1,3
1630 SUMSL(L)= SUMSL(L) - EG(JG,KG)*VI*COS2(L)
1640 CONTINUE
1650 CONTINUE
1660 CONTINUE
C
DO 1670 L=1,3
1670 VVINDX(J,K,L) = SUMSL(L)*EXECK(1)
IF (NZERO-2) 1690,1680,1680
1680 M = NSPV +1 -J
VVINDX(M,K,1)= VVINDX(J,K,1)
VVINDX(M,K,2)= -VVINDX(J,K,2)
VVINDX(M,K,3)= VVINDX(J,K,3)
C
1690 CONTINUE
1700 CONTINUE
C
C
C      * WING COEFFICIENTS *
C
FACT1= 2.0/WINGD(6)
FACT2= FACT1/WINGD(9)
FACT3= FACT1/WINGD(1)
WPM0= 0.0
WRM0= 0.0
WYN0= 0.0
WCLV= 0.0
WCDV= 0.0
WPMV= 0.0
WRMV= 0.0
WYNV= 0.0
NM=0
DO 1710 L=1,4
1710 SUMWL(L)= 0.0
C
DO 1990 J=1,NSPV
C
YSPN= EN(J,1,2)
YA= ABS(YSPN)
M= -1

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```

      DO 1740 L=2,10
      IF (M) 1720,1740,1740
1720 TEST= YA-EYE(L)
      IF (TEST) 1730,1740,1740
1730 M= L
1740 CONTINUE
      IF (M-2) 1750,1760,1760
1750 M = 2
1760 M1= M-1
C
      RATS= (YA-EYE(M1))/(EYE(M)-EYE(M1))
      XLE = ELE(M1) + RATS*(ELE(M)-ELE(M1))
      XHE = EHE(M1) + RATS*(EHE(M)-EHE(M1))
      TANL= (ELF(M)-ELE(M1))/(EYE(M)-EYE(M1))
      COSLE= SQRT(1.0+TANL**2)
C
      DO 1960 K=1,NCV
      NM= NM+1
C
      COSI(1)= VVINDX(J,K,1) + COSA
      COSI(2)= VVINDX(J,K,2)
      COSI(3)= VVINDX(J,K,3) - SINA
C
      I = J+1
      DO 1770 L=1,3
      B(L)= EV(J,K,L)
      D(L)= EV(I,K,L)
1770 P(L)= D(L)*B(L)
      YSPN = B(2)
      CALL FLAPS(YSPN,XHE,B,COS3)
      YSPN = D(2)
      CALL FLAPS(YSPN,XHE,D,COS3)
      YSPN = P(2)
      SUMB = 0.0
      DO 1780 L=1,3
      COS2(L)= D(L)-B(L)
1780 SUMB = SUMB + COS2(L)**2
      SUMB = SQRT(SUMB)
      DO 1790 L=1,3
1790 COS2(L)= COS2(L)/SUMB
C
      CALL FLAPS(YSPN,XHE,P,COS3)
C
      CALL CROSP(COS1,COS2,COS3)
C
      SLIFT= (EY(J,K)/COS2(2))*EG(IJ,K)
C
      DO 1800 L=1,3
1800 SUMSL(L)= SLIFT*COS3(L)
C
      XARM = P(1) - WEND(1)
      YARM = P(2)
      ZARM = P(3) - WEND(12)
      WPMO = WPMO + ( XARM*SUMSL(3) + ZARM*SUMSL(1) ) *EXECK(13)
      WRMO = WRMO - ( YARM*SUMSL(3) + ZARM*SUMSL(2) )
      WYMO = WYMO - ( YARM*SUMSL(1) - XARM*SUMSL(2) )
      SCTS = -SUMSL(1)
      IF (SCTS) 1810,1810,1820
1810 SCTS = 0.0
1820 SNFC = COSLE*SCTS
      IF (SUMSL(3)) 1830,1840,1840
1830 SNFC = -SNFC
1840 CONTINUE
      WCLV= WCLV + SNFC
      WCDV= WCDV + SCTS
      XARM = XLE - WEND(11)
      WPMV = WPMV + ( XARM*SNFC + ZARM*SCTS )
      WRMV = WRMV - ( YARM*SNFC )
      WYMV = WYMV - ( YARM*SCTS )
C
      DO 1850 L=1,3
1850 SUMWL(L)= SUMWL(L) + SUMSL(L)
C
      IF (EXECK(15)-1.0) 1860,1950,1950
1860 IF (IFLG(10)-2) 1550,1870,1870
1870 IF (NM-1) 1880,1880,1930
1880 LINES= LINES+4
      IF (LINEX-LINES) 1890,1900,1900
1890 CALL PAGE
      LINES= LINES+4
1900 WRITE (KOUT,1050)
      LINES= LINES+2
      IF (LINEX-LINES) 1910,1920,1920
1910 CALL PAGE
      LINES= LINES+2
1920 WRITE (KOUT,1060)
1930 LINES= LINES+1
      IF (LINEX-LINES) 1910,1940,1940
1940 CPLIFT= -2.0*SUMSL(3)/ES(J,K)
      WRITE (KOUT,1070) J,K,(P(I),I=1,3),ES(I,J,K),CPLIFT,(COS3(I),I=1,3),
      IVVINDX(J,K,I),I=1,3),EG(I,J,K)
1950 CONTINUE
C
      1960 CONTINUE
C
      IF (EXECK(15)-1.0) 1970,1990,1990
1970 IF (IFLG(10)-2) 1990,1980,1980
1980 WRITE (KOUT,1000)
      LINES=LINES+1
1990 CONTINUE
C
      SUMWL(4)= 0.0
      DO 2000 L=1,3

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2000 SUMWL(4)= SUMWL(4) + SUMWL(L1)**2
      SUMWL(4)= SQRT(SUMWL(4))
      DO 2010 L=1,3
2010 SUMWL(L1)= SUMWL(L1)/SUMWL(4)
C
      WCL=-FACT1*SUMWL(4)*(SUMWL(3)*COSA+SUMWL(1)*SINA)
      WCD= FACT1*SUMWL(4)*(SUMWL(1)*COSA-SUMWL(3)*SINA)
      WPMO= WPMO*FACT2
      WRMO= WRMO*FACT3
      WYMO= WYMO*FACT3
      SNFC= FACT1*( WCLV*COSA + WCDV*SINA )
      SCTS= FACT1*( WCDV*COSA - WCLV*SINA )
      WPMV = WPMO + FACT2*WPMV
      WRMV= WRMO + FACT3*WRMV
      WYMV= WYMO + FACT3*WYMV
      WCLV= WCL - SNFC
      WCDV= WCD + SCTS
C
      IF (EXECK(15)-1.C) 2020,2050,2050
2020 LINES= LINES+3
      IF (LINEX-LINES) 2030,2040,2040
2030 CALL PAGE
      GO TO 2050
2040 WRITE (KOUT,10101
2050 CONTINUE
C
      EXECK(2)= WCL
      EXECK(3)= WPMO
      EXECK(4)= WRMO
      EXECK(5)= WYMO
      EXECK(6)=(WCLV-WCL)
      EXECK(7)=(WPMV-WPMO)
      EXECK(8)=(WCDV-WCD)
      EXECK(9)= WCD
C
      IF (EXECK(15)-1.C) 2060,2250,2250
2060 CONTINUE
C
C * SECTION COEFFICIENTS *
C
      NJ= 0
C
      DO 2220 J=NZERO,A邵V
C
      NJ=NJ+1
C
      SPMO= 0.0
      YSPN= EN(J,L,2)
C
      CALL CHORDT(YSPN,XLE,XCO4,XTE,XHE,CW,CF)
C
      CORD= CW**2
C
      DO 2070 L=1,4
2070 SUMSL(L1)= 0.0
C
      DO 2120 K=1,NCV
C
      COS1(1)= VVINDX(J,K,1) + COSA
      COS1(2)= VVINDX(J,K,2)
      COS1(3)= VVINDX(J,K,3) - SINA
C
      I = J+1
      DO 2080 L=1,3
      R(L)= EV(I,K,L)
      D(L)= EV(I,K,L)
2080 P(L)= 0.5*( B(L)+D(L) )
      YSPN = B(2)
      CALL FLAPS(YSPN,XHE,B,COS31
      YSPN = D(2)
      CALL FLAPS(YSPN,XHE,D,COS3)
      YSPN = P(2)
      SUMR = C.0
      DO 2090 L=1,3
      COS2(L)= D(L)-B(L)
2090 SUMB = SUMB + COS2(L)**2
      SUMB = SQRT(SUMB)
      DO 2100 L=1,3
2100 COS2(L)= COS2(L)/SUMB
      CALL FLAPS(YSPN,XHE,P,COS3)
C
      CALL CROSP(COS1,COS2,COS3)
C
      SLIFT= EG(J,K)/CCS2(2)
C
      DO 2110 L=1,3
2110 SUMSL(L1)= SUMSL(L1) + SLIFT*COS3(L)
C
      XARM= EVI(J,K,1) + 0.5*EV(J,K)*EV(J,K,4)/EV(J,K,5) - XCO4
      SPMO= SPMO + SLIFT*COS3(3)*XARM
C
2120 CONTINUE
C
      DO 2130 L=1,3
2130 SUMSL(4)= SUMSL(4) + SUMSL(L1)**2
      SUMSL(4)= SORT(SUMSL(4))
      DO 2140 L=1,3
2140 SUMSL(L1)= SUMSL(L1)/SUMSL(4)
C
      SCL= SUMSL(4)*2.0/CW
      SPMO= SPMO*2.0/CORD
C
      IF (INJ-L1) 2150,2150,2200
2150 LINES= LINES+4

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IF (LINEX-LINESI) 2160,2170,2170          804 6580      5224
2160 CALL PAGE                           804 6590      5225
    LINES= LINES+4                         804 6600      5226
2170 WRITE (KOUT,1080)                      804 6610      5227
    LINES=LINES+2                         804 6620      5228
    IF (LINEX-LINESI) 2180,2190,2190          804 6630      5229
2180 CALL PAGE                           804 6640      5230
    LINES= LINES+2                         804 6650      5231
2190 WRITE (KOUT,1090)                      804 6660      5232
2200 LINES= LINES+1                         804 6670      5233
    IF (LINEX-LINESI) 2180,2210,2210          804 6680      5234
2210 Y0B1 EN(J,1,2)/BOTU                  804 6690      5235
    SPL = 0.5*SCL*CW/BOTU                 804 6700      5236
    SLIFT= SCL*CW*EY(J,1)/WINGD(6)        804 6710      5237
    WRITE (KOUT,1100)J,Y0B,EN(J,1,2),CW,SCL,SPL,SLIFT,SPMO,(SUMSL(I),I=1,3)
    I=1,3)                                804 6720      5238
C                                         804 6730      5239
C                                         804 6740      5240
2220 CONTINUE                           804 6750      5241
C                                         804 6760      5242
C                                         804 6770      5243
    CALL INTERP(ALFA,ZHEIGT,WCL,WCD)       804 6780      5244
C                                         804 6790      5245
C                                         804 6800      5246
    RATS= SQRT (WCDV**2 + WCLV**2 )        804 6810      5247
    COS3(1)= ( WCDV*COSA - WCLV*SINA )/RATS 804 6820      5248
    COS3(2)= 0.0                            804 6830      5249
    COS3(3)= (-WCLV*COSA - WCDV*SINA )/RATS 804 6840      5250
C                                         804 6850      5251
    LINES=LINE+11                         804 6860      5252
    IF (LINEX-LINESI) 2230,2240,2240          804 6870      5253
2230 CALL PAGE                           804 6880      5254
    LINES= LINES +11                        804 6890      5255
2240 WRITE (KOUT,1110)WCL,WCD,WMPO,WRMD,WYMO,(SUMML(I),I=1,3),DETERM,SC08
    IALE,WCLV,WCDV,WPMV,WRMV,WYMV,(COS3(I),I=1,3) 804 6910      5256
    LINES=LINE+10                         804 6920      5258
C                                         804 6930      5259
C                                         804 6940      5260
2250 RETURN                               804 6950      5261
C                                         XXXXXX
C                                         804 6960      5262
C                                         804 6970      5263
C                                         804 6980      5264
C                                         END          804 6990      5265

V FOR B05,B05                           805 10       5266
C                                         805 20       5267
C                                         805 30       5268
C                                         805 40       5269
C                                         805 50       5270
C                                         805 60       5271
C                                         * TRM MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *B05 70 5272
C                                         * PROGRAM DEVELOPED BY A.V.GOMEZ (TRM SYSTEMS) ON MARCH-MAY 1971 *B05 80 5273
C                                         805 90       5274
C                                         XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXB05 100 5275
C                                         805 110      5276
C                                         DIMENSION XFUN(11), CFUN(31)           805 120      5277
C                                         DIMENSION YSPAN(22), XCORD(22), SPRES(22) 805 130      5278
C                                         DIMENSION SLIFT(22), SDRAG(22), CMONT(22) 805 140      5279
C                                         DIMENSION ALIFT(42),ADRAG(42),AMONT(42) 805 150      5280
C                                         DIMENSION FLAPN(22),FLAPX(22),AFLPN(42),AFLPX(42) 805 160      5281
C                                         DIMENSION SCLV(22),SPMV(22),SCDV(22),ACLV(42),APMV(42),ACDV(42) 805 170      5282
C                                         DIMENSION COS1(3),COS2(3),COS3(3)       805 180      5283
C                                         DIMENSION SUMSL(4),B(3),D(3),F(3)       805 190      5284
C                                         805 200      5285
C                                         COMMON/DATA01/KIN ,KOUT ,KT1 ,KT2 ,LINEX ,LINES 805 210      5286
C                                         COMMON/DATA02/IFLG(15) ,EXCK(15) ,RAO ,PIE 805 220      5287
C                                         COMMON/DATA05/WINGD(15) ,EY142,10) ,EC(42,10) ,ES(42,10) 805 230      5288
C                                         *,EYE(10) ,ELE(10) ,EFE(10) ,EG(42,10) 805 240      5289
C                                         *,ENI42,10,6) ,EV(42,10,6) ,VVINDX(42,10,3) 805 250      5290
C                                         COMMON/DATA06/YFF11,YFF12,YFF21,YFF22,YFF31,YFF32,DELTF1,DELTF2 805 270      5292
C                                         * ,NOFLAP,NOAILR 805 280      5293
C                                         DATA XFUN/ D.0,0.1,0.2,0.3,0.4,0.5,0.6,0.7,0.8,0.9,1.0/ 805 290      5294
C                                         805 300      5295
C                                         805 310      5296
C                                         805 320      5297
1000 FORMAT(1X)                           805 330      5298
1010 FORMAT(1X,/,1X)                      805 340      5299
C                                         805 350      5300
1020 FORMAT(4IX,3RHCHORDWISE PRESSURE DISTRIBUTION DETAIL,/,4IX,38(1H*B05 360 5301
    1//,19X,19(2H* ),23HCHORD STATION (X-XLE)/C,19(2H *),/,19X, 805 370 5302
    2 11F9.5//,19H      2Y/B   SCL ,L8(2H* ),29HCHORD PRESSURE (CPL 805 380 5303
    3-CPU)*12L,17(2H *),/,1X ) 805 390 5304
1030 FORMAT(1X,13F9.5 )                   805 400 5305
C                                         805 410 5306
1040 FORMAT(4IX,4IHSpanwise SECTION LIFT DISTRIBUTION DETAIL,/,4IX,41(1H*B05 420 5307
    1H*1//,33X15HNWITH LE SUCTION,16X,13HNLE SUCTION,17X,12HFLAP/AILB05 430 5308
    ZERON,/,5X,20H      Y      2Y/B   ,2(30H   SCL   SCDI   SCH(05 440 5309
    3C/4)),      30H   FCN      FCX   FCH   ,/,1X) 805 450 5310
1050 FORMAT(5X,F10.3,10F10.6 )          805 460 5311
C                                         805 470 5312
1060 FORMAT(1X,/,1X,14H(EDF PLOT FILE,I3,1H) ) 805 480 5313
C                                         805 490 5314
C                                         XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXB05 500 5315
C                                         805 510 5316
C                                         805 520 5317
C                                         805 530 5318
C                                         805 540 5319
C                                         * INITIALIZE *
C                                         IF (IFLG(11)-1) 1630,1070,1070          805 550 5320
1070 CONTINUE                           805 560 5321
C                                         805 570 5322
    ZERO = 0.0                           805 580 5323
    ZERO1= 0.0                          805 590 5324
C                                         805 600 5325
C                                         805 610 5326

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      ZERO2= 0.0
C      NO= 0
C      N1= 1
C      N2= 2
C      NSPV = IFLG(3)
C      NCV = IFLG(6)
C      IREC4 = 1
C      IWORD1= 2
C      IWORD2= 10
C      SPAN = WINGD(1)
C      WAREA= WINGD(6)
C      WMGC = WINGD(9)
C      BOTU = SPAN/2.0
C      BETAM= EXECK(1)
C      WCL = EXECK(2)
C      WPMO = EXECK(3)
C      WRMN = EXECK(4)
C      WYMO = EXECK(5)
C      FACT1= 2.0/WINGD(6)
C      FACT2= FACT1/WINGD(9)
C      FACT3= FACT1/WINGD(1)
C      ALFAR= ALFA/RAD
C      TANA = TANALFARI
C      COSA = 1.0/SQRT(1.0+TANA**2)
C      SIN = TANA*COSA
C      NZERO= 1
C      IF (IFLG(1)=1) 1080,1090,1090
1080 CONTINUE
      NSPO2= NSPV/2
      NTTEST= NSPV-NSPO2*2
      NZERO= NSPO2 + 1
1090 CONTINUE
C      LINES= LINES +3
C      IF (LINESX-LINES) 1100,1110,1110
1100 CALL PAGE
      LINES= LINES +3
1110 WRITE (KOUT,1010)
C
C      * SECTION COEFFICIENTS *
C      NJ= 0
C
C      NSPAN = 0
C
C      DO 1390 J=NZERO,NSPV
C      J2= J+1
C      NJ=NJ+1
C      NSPAN = NSPAN+1
C
C      YSPN= EN(J,1,2)
C
C      YA= ABS(YSPN)
C      Mx = -1
C      DO 1140 L=2,10
C      IF (M) 1120,1140,1140
1120 TEST= YA-EYE(L)
      IF (TEST) 1130,1130,1140
1130 M= L
1140 CONTINUE
      IF (M-2) 1150,1160,1160
1150 M= 2
1160 M1= M-1
C
      RATS= (YA-EYE(M1))/(EYE(M)-EYE(M1))
      XLE = ELE(M1) + RATS*( ELE(M)-ELE(M1) )
      XTE = ETE(M1) + RATS*( ETE(M)-ETE(M1) )
      XHE = EHE(M1) + RATS*( EHE(M)-EHE(M1) )
      CW = XTE-XLE
      CF = XTE-XHE
      XC04= XLE* CW*0.25
      TANLE = (ELE(M)-ELE(M1))/(EYE(M)-EYE(M1))
      COSLE = SQRT(1.0 + TANLE**2)
C
      CORD= CW**2
C
C      * SECTION LIFT LOOP *
C
      NX = 0
C
      SPMO= 0.0
C
      DO 1170 L=1,4
1170 SUMSL(L)= 0.0
C
      DO 1220 K=1,NCV
C
      NX= NX+1
C
      COS1(1)= VVINDX(J,K,1) + COSA
      COS1(2)= VVINDX(J,K,2)
      COS1(3)= VVINDX(J,K,3) - SIN
C
      805 620      5327
      805 630      5328
      805 640      5329
      805 650      5330
      805 660      5331
      805 670      5332
      805 680      5333
      805 690      5334
      805 700      5335
      805 710      5336
      805 720      5337
      805 730      5338
      805 740      5339
      805 750      5340
      805 760      5341
      805 770      5342
      805 780      5343
      805 790      5344
      805 800      5345
      805 810      5346
      805 820      5347
      805 830      5348
      805 840      5349
      805 850      5350
      805 860      5351
      805 870      5352
      805 880      5353
      805 890      5354
      805 900      5355
      805 910      5356
      805 920      5357
      805 930      5358
      805 940      5359
      805 950      5360
      805 960      5361
      805 970      5362
      805 980      5363
      805 990      5364
      805 1000     5365
      805 1010     5366
      805 1020     5367
      805 1030     5368
      805 1040     5369
      805 1050     5370
      805 1060     5371
      805 1070     5372
      805 1080     5373
      805 1090     5374
      805 1100     5375
      805 1110     5376
      805 1120     5377
      805 1130     5378
      805 1140     5379
      805 1150     5380
      805 1160     5381
      805 1170     5382
      805 1180     5383
      805 1190     5384
      805 1200     5385
      805 1210     5386
      805 1220     5387
      805 1230     5388
      805 1240     5389
      805 1250     5390
      805 1260     5391
      805 1270     5392
      805 1280     5393
      805 1290     5394
      805 1300     5395
      805 1310     5396
      805 1320     5397
      805 1330     5398
      805 1340     5399
      805 1350     5400
      805 1360     5401
      805 1370     5402
      805 1380     5403
      805 1390     5404
      805 1400     5405
      805 1410     5406
      805 1420     5407
      805 1430     5408
      805 1440     5409
      805 1450     5410
      805 1460     5411
      805 1470     5412
      805 1480     5413
      805 1490     5414
      805 1500     5415
      805 1510     5416
      805 1520     5417
      805 1530     5418
      805 1540     5419
      805 1550     5420
      805 1560     5421
      805 1570     5422
      805 1580     5423
      805 1590     5424
      805 1600     5425
      805 1610     5426
      805 1620     5427
      805 1630     5428
      805 1640     5429
      805 1650     5430
      805 1660     5431
      805 1670     5432

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I = J+1                                805 1680      5433
DO 1180 L=1,3                            805 1690      5434
B(L)= EV(J,K,L)                         805 1700      5435
D(L)= EV(I,K,L)                         805 1710      5436
1180 P(L)= 0.5*(B(L)+D(L)) 1           805 1720      5437
YSPN = B(2)                             805 1730      5438
CALL FLAPS(YSPN,XHE,B,COS3)            805 1740      5439
YSPN = D(2)                             805 1750      5440
CALL FLAPS(YSPN,XHE,D,COS3)            805 1760      5441
YSPN = P(2)                             805 1770      5442
SUM8 = 0.0                             805 1780      5443
DO 1190 L=1,3                            805 1790      5444
COS2(L)= D(L)-B(L)                     805 1800      5445
1190 SUM8 = SUM8 + COS2(L)**2          805 1810      5446
SUM8 = SQRT(SUM8)                      805 1820      5447
DO 1200 L=1,3                            805 1830      5448
1200 COS2(L) = COS2(L)/SUM8            805 1840      5449
C                                     CALL FLAPS(YSPN,XHE,P,COS3)
C                                     CALL CROSP(COS1,COS2,COS3)
C                                     ZLIFT* EG(J,K)/COS2(2)
C                                     SPRES(NX)= 2.0*ZLIFT*COS3(3)/EC(J,K)
C                                     XCORD(NX)= (P(1)-XLE)/CW
C                                     DO 1210 L=1,3
1210 SUMSL(L)= SUMSL(L) + ZLIFT*COS3(L)
C                                     XARM= P(1)-XC04
C                                     SPMD= SPMD + ZLIFT*COS3(3)*XARM
C                                     1220 CONTINUE
C                                     FLAPN(NSPAN) = -2.0*ZLIFT*COS3(3)/EC(J,NCV)
C                                     FLAPX(NSPAN) = 2.0*ZLIFT*COS3(L)/EC(J,NCV)
C                                     DO 1230 L=1,3
1230 SUMSL(4)= SUMSL(4) + SUMSL(L)**2
SUMSL(4)= SQRT(SUMSL(4))
DO 1240 L=1,3
1240 SUMSL(L)= SUMSL(L)/SUMSL(4)
SUMSL(4)= 2.0*SUMSL(4)/CW
C                                     NX= NX+1
C                                     SPRES(NX)= 0.0
C                                     XCORD(NX)= 1.0
C                                     CALL CURFIT(XCORD,SPRES,ALIFT, NX,ZERO1,ZERO2,N2,N3)
C                                     YSPAN(NSPAN)= YSPN/ROTU
C                                     SLIFT(NSPAN)= SUMSL(4)*(SUMSL(3)*COSA + SUMSL(1)*SINA)
C                                     SDRAG(NSPAN)= SUMSL(4)*(SUMSL(1)*COSA - SUMSL(3)*SINA)
C                                     CMNT(NSPAN)= 2.0*SPMD/CORD
C                                     SCTS = -SUMSL(4)*SUMSL(1)
IF (SCTS) 1250,1250,1260
1250 SCTS = 0.0
1260 SNFC = COSLE*SCTS
IF (SUMSL(3)) 1270,1280,1280
1270 SNFC = -SNFC
1280 CONTINUE
SLV(NSPAN) = SLIFT(NSPAN) - SNFC*COSA - SCTS*SINA
SCD(NSPAN) = SDRAG(NSPAN) + SCTS*COSA - SNFC*SINA
SPM(NSPAN) = CMNT(NSPAN) - SNFC*(XC04-XLE)/CW
C                                     DXARG= XCORD(NSPAN)/30.0
C                                     DO 1300 K=1,31
C                                     XARG = DXARG*FLOAT(K-1)
YARG = 0.0
C                                     IF (K-1) 1300,1300,1290
1290 CONTINUE
C                                     CALL CURVE(XCORD,SPRES,ALIFT, XARG,YARG,DUMYK,NK,NL)
C                                     1300 CPFUN(K)= -YARG
C                                     IF (J-NZERO) 1310,1310,1340
1310 LINES= LINES + 9
IF (LINEX-LINES) 1320,1330,1330
1320 CALL PAGE
LINES* LINES + 9
1330 WRITE (KOUT,10201(XFUN(I)),I=1,11)
1340 IF (LINEX-LINES) 1320,1350,1350
1350 LINES= LINES+1
WRITE (KOUT,1030) YSPAN(NSPAN),SLIFT(NSPAN),(CPFUN(I),I=1,31,31)
C                                     IF (IFLG(13)-1) 1390,1360,1360
1360 CONTINUE
C                                     DO 1370 K=1,31
XARG = DXARG*FLOAT(K-1)
1370 WRITE (KT2,IREC4,IWORD1,XARG,CPFUN(K)
IREC4 = IREC4 + 1
IF (J-NSPV) 1390,1380,1380
1380 END FILE KT2

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IREC4= 1
LINES= LINES +2
IFLG(15)= [FLG(15) +1
WRITE (KOUT,1060)IFLG(15)

C
C 1390 CONTINUE
C
C
LINES= LINES+3
IF (LINEX-LINES) 1400,1410,1410
1400 CALL PAGE
LINES= LINES+3
GO TO 1420
1410 WRITE (KOUT,1010)
1420 CONTINUE
C
C
CALL CURFIT(YSAN, SLIFT,ALIFT, NSPAN,ZEROL,ZERO2,N2,N2)
CALL CURFIT(YSAN, SDRAG,ADRAG, NSPAN,ZEROL,ZERO2,N2,N2)
CALL CURFIT(YSAN, CMONT,AMONT, NSPAN,ZEROL,ZERO2,N2,N2)
CALL CURFIT(YSAN, FLAPN,AFLPN, NSPAN,ZEROL,ZERO2,N2,N2)
CALL CURFIT(YSAN, FLAPX,AFLPX, NSPAN,ZEROL,ZERO2,N2,N2)
CALL CURFIT(YSAN, SCLV, ACLV, NSPAN,ZEROL,ZERO2,N2,N2)
CALL CURFIT(YSAN, SCDV, ACDV, NSPAN,ZEROL,ZERO2,N2,N2)
CALL CURFIT(YSAN, SPMV, APMV, NSPAN,ZEROL,ZERO2,N2,N2)

C
C
DELTAB = 1.0/20.0
WCLCF = 0.0
WCDCF = 0.0
SUMSS = 0.0
C
DO 1580 J=1,41
YOB= DELTAB*FLOAT(J-1) - 1.0
YOB= YOB
YSPN= YOB*BOTU
C
IF (NZERO-1) 1440,1440,1430
1430 YOB= ABS(YOB)
1440 CONTINUE
C
CL = 0.0
CD = 0.0
CM = 0.0
CLV = 0.0
CDV = 0.0
CPV = 0.0
FCN = 0.0
FCX = 0.0
C
TEST= ABS(YOB) - 0.999
IF (TEST) 1450,1460,1460
1450 CONTINUE
C
CALL CURVE(YSAN,SLIFT,ALIFT, YOB,CL, DUMYK,NSPAN,N1)
CALL CURVE(YSAN, SDRAG,ADRAG, YOB,CD, DUMYK,NSPAN,N1)
CALL CURVE(YSAN, CMONT,AMONT, YOB,CM, DUMYK,NSPAN,N1)
CALL CURVE(YSAN, FLAPN,AFLPN, YOB,FCN,DUMYK,NSPAN,N1)
CALL CURVE(YSAN, FLAPX,AFLPX, YOB,FCX,DUMYK,NSPAN,N1)
CALL CURVE(YSAN, SCLV, ACLV, YOB,CLV,DUMYK,NSPAN,N1)
CALL CURVE(YSAN, SCDV, ACDV, YOB,CDV,DUMYK,NSPAN,N1)
CALL CURVE(YSAN, SPMV, APMV, YOB,CPV,DUMYK,NSPAN,N1)

C
1460 CONTINUE
C
CALL CHORDT(YSAN,XLE,XCD4,XTE,XHE,CW,CF)
C
FCM = -FCN/4.0
C
CLC1 = CL*CW
CDC1 = CD*CW
CWC1 = CW
C
IF (J-1) 1480,1480,1470
1470 WCLCF = WCLCF + DELTAB*(CLC1+CLC2)
WCDCF = WCDCF + DELTAB*(CDC1+CDC2)
SUMSS = SUMSS + DELTAB*(CWC1+CWC2)
1480 CLC2 = CLC1
CDC2 = CDC1
CWC2 = CWC1
C
IF (J-1) 1490,1490,1520
1490 LINES= LINES+7
IF (LINEX-LINES) 1500,1510,1510
1500 CALL PAGE
LINES= LINES+7
1510 WRITE (KOUT,1040)
1520 IF (LINEX-LINES) 1500,1530,1530
1530 LINES= LINES +1
NOFLPX= NOFLAP + NDAILR
IF (NOFLPX) 1540,1540,1550
1540 WRITE (KOUT,1050) YSPN,YOB,CL,CD,CM,CLV,CDV,CPV
GO TO 1560
1550 WRITE (KOUT,1050) YSPN,YOB,CL,CD,CM,CLV,CDV,CPV,FCN,FCX,FCM
1560 CONTINUE
C
IF ([IFLG(14)-1]) 1580,1570,1570
1570 WRITE(KT2)IREC4,IWORD2,YOB,CL,CD,CM,FCN,FCX,FCM,CLV,CDV,CPV
C

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ORIGINAL PAGE IS  
OF POOR QUALITY

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1580 CONTINUE
C
C      WCLCF = WCL
C      WCDCF = WCDCF/SUMSS
C
C      LINES= LINES+3
C      IF (LINEX-LINES) 1590,1600,1600
1590 CALL PAGE
C      LINES= LINES+3
1600 WRITE (KOUT,1010)
C
C      IF (IFLG(14)=1) 1620,1610,1610
1610 END FILE KT2
C      LINES= LINES +2
C      IFLG(15)= IFLG(15) +1
C      WRITE (KOUT,1060)IFLG(15)
1620 CONTINUE
C
C      1630 RETURN
C      XXXXXX
C
C      END

D FOR B06,B06
C
C      SUBROUTINE DLINERIALFA,ZHEIGT,ALFAL,WINGCL,NJUBLI
C
C      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *B06 70
C      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *B06 80
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX B06 100
C
C      DIMENSION YSPAN(22)
C      DIMENSION ALFAL(20), WINGCL(21)
C      DIMENSION CLA1(32),CLB(32),RCL(2,32),RCM(2,32),RYSPAN(32)
C      DIMENSION SCLV(22),SPMV(22),SCDV(22),ACLV(42),APMV(42),ACDV(42)
C      DIMENSION RCD(2,32),RCLV(2,32),RCDV(2,32),RPMV(2,32)
C      DIMENSION WCLV(52),WCDIS(2),WCPVS(2), MCPOS(2),WCDIS(2)
C      DIMENSION SLIFT(22),SDRAG(22),CMONT(22)
C      DIMENSION ALIFT(42),ADRAG(42),AMONT(42)
C      DIMENSION FLAPN(22),FLAPX(22),AFLPN(42),AFLPX(42)
C      DIMENSION RCFL(2,32), RCFD(2,32)
C
C      DIMENSION COSI(3),CDS2(3),CDS3(3)
C      DIMENSION SUMSL(4),B(3),D(3),P(3)
C      DIMENSION WCD3(3),WCL3(3),WCL4(3)
C
C      COMMON/DATA01/KIN ,KOUT ,KT1 ,KT2 ,LINEX ,LINES
C      COMMON/DATA02/IFLG(15) ,EXECK(15) ,RAD ,PIE
C      COMMON/DATA05/WINGD(15) ,FY(42,10) ,EC(42,10) ,ES(42,10) B06 290
C      *,EY(10) ,ELF(10) ,ETE(10) ,EHE(10) ,EG(42,10) B06 300
C      *,ENI(42,10,6) ,EV(42,10,6) ,VVINDX(42,10,3)
C      COMMON/DATA06/YFF11,YFF12,YFF21,YFF22,YFF31,YFF32,DELTFL,DELTFL2
C      *
C      ,NOFLAP,NOAILR
C      COMMON/DATA07/LFLAP,LDRAG
C
C      B06 270
C      B06 280
C      B06 290
C      B06 300
C      B06 310
C      B06 320
C      B06 330
C      B06 340
C      B06 350
C      B06 360
C      B06 370
C      B06 380
C      B06 390
C      B06 400
C      B06 410
C      B06 420
C      B06 430
C      B06 440
C      B06 450
C      B06 460
C      B06 470
C      B06 480
C      B06 490
C      B06 500
C      B06 510
C      B06 520
C      B06 530
C      B06 540
C      B06 550
C      B06 560
C      B06 570
C      B06 580
C      B06 590
C      B06 600
C      B06 610
C      B06 620
C      B06 630
C      B06 640
C      B06 650
C      B06 660
C      B06 670
C      B06 680
C      B06 690
C      B06 700
C      B06 710
C      B06 720
C      B06 730
C      B06 740
C      B06 750
C      B06 760
C
C      1000 FORMAT(1X)
C      1010 FORMAT(1X,/,1X)
C
C      1020 FORMAT(42X,35HLINEARIZED SOLUTION WITH LE SUCTION/42X35(1H*1//25X,B06 410
C      1 60H   ALFA    ALFARD   WCL    WCL   CMP    CMR
C      2 10H     CHY    ,/,45X,40H    SLOPE   SLOPE //B06 420
C      3,25X,2F10.3,F10.4,4F10.5,/,1X) B06 430
C
C      1030 FORMAT(30X,50H
C      1 10H SCM(1/4),/,1X)
C
C      1040 FORMAT(30X, F10.3, 5F10.5 )
C
C      1050 FORMAT(34X,15HWITH LE SUCTION,16X,13HNO LE SUCTION,17X,12HFLAP/AILB06 510
C      1 ERON,/,5X,20H   Y    2Y/B  +2(30H SCL   SCDI  SCM( B06 520
C      2C/41), 30H FCN   FCX   FCH   ,/,1X) B06 530
C
C      1060 FORMAT(5X,F10.3,10F10.6)
C
C      1070 FORMAT(1X,/,17X,18HWITH LE SUCTION ,4MWCL=,F10.5,8H / WCDI=,F10.6
C      15,12H / WCM(C/4)=,F10.5, 7H / L/D=,F10.5,/,18X,13HNO LE SUCTION,4XB06 570
C      2, 4X,F10.5,2H / ,EX,F10.5,2H /,10X,F10.5,2H /,5X,F10.5 +
C
C      1080 FORMAT(41X,37HLINEARIZED SOLUTION WING COEFFICIENTS/,41X,37(1H*1),B06 600
C      1 //,44X,15HWITH LE SUCTION,17X,13HNO LE SUCTION,/,,
C      2 30X,5HALFA = 2(30H WCL   WCD   WCM(C/41),/,1X) B06 610
C
C      1090 FORMAT( 25X, F10.3, 6F10.4 )
C
C      1100 FORMAT(1X,/,1X,14H(EOF PLOT FILE,I3-1H) )
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX B06 620
C
C      * INITIALIZE *
C
C      NO= 0
C      N1= 1
C      N2= 2

```

```

NSPV = IFLG(3)
NCV = IFLG(6)
NCLFLG= 1
C
ZERO = 0.0
ZERO1= 0.0
ZERO2= 0.0
C
SPAN = WINGD(1)
WAREA= WINGD(6)
WNCG = WINGD(9)
BOTU = SPAN/2.0
C
FACT1= 2.0/WINGD(6)
FACT2= FACT1/WINGD(9)
FACT3= FACT1/WINGD(1)
SKINF= EXECK(10)*2.0
DEALF= EXECK(12)
EXECK(15)= 2.0
C
NZERO= 1
IF (IFLG(1)-1) 1110,1120,1120
1110 CONTINUE
NSP02= NSPV/2
NTEST= NSPV-NSP02*2
NZERO= NSP02 + 1
1120 CONTINUE
C
C * LINEARIZED LIFT TWO PASS LOOP *
C
DO 1120 VLCL=L,2
C
IF (NCLFLG) 1130,1140,1140
1130 ALFA= ALFA + DEALF
C
CALL DLIFT( ALFA,ZHEIGHT)
C
GO TO 1150
1140 NCLFLG= -1
C
BETAM= EXECK(1)
MCL = EXECK(2)
WPMO = EXECK(3)
WRMO = EXECK(4)
WYMO = EXECK(5)
C
1150 CONTINUE
C
ALFAR= ALFA/RAO
TANA = TAN(ALFAR)
COSA = 1.0/SQRT(1.0+TANA**2)
SINA = TANA*COSA
WCP05(NCLC)= EXECK(3)
MCLVS(NCLC)= EXECK(6)
WCDVS(NCLC)= EXECK(8)
WCPVS(NCLC)= EXECK(7)
WCDIS(NCLC)= EXECK(9)
C
C * SECTION COEFFICIENTS *
C
NJ= 0
C
NSPAN = 0
C
DO 1130 J=NZERO,NSPV
C
J2= J+1
NJ=NJ+1
NSPAN = NSPAN+1
C
YSPN= FN(J,1,2)
C
YA= ABS(YSPN)
M = -1
C
DO 1180 L=2,10
IF (M) 1160,1180,1180
1160 TEST= YA-EYE(L)
IF (TEST) 1170,1170,1180
1170 M= L
1180 CONTINUE
IF (M-2) 1190,1200,1200
1190 M= 2
1200 M1= M-1
C
RATS= (YA-EYE(M1))/(EYE(M)-EYE(M1))
XLE = ELE(M1) + RATS*( ELE(M)-ELE(M1) )
XTE = ETE(M1) + RATS*( ETE(M)-ETE(M1) )
XHE = EHE(M1) + RATS*( EHE(M)-EHE(M1) )
CW = XTE-XLE
CF = XTE-XHE
XCD4= XLE + CW*C.25
TANLF = (ELF(M)-ELE(M1))/(EYE(M)-EYE(M1))
COSLE = SQRT(1.0+TANLF**2)
C
CORD= CW**2

```

```

C * SECTION LIFT LOOP *
C
C      SPMO= 0.0
C
C      DO 1210 L=1,4
1210 SUMSL(L)= 0.0
C
C      DO 1260 K=1,NCV
C
C      COS1(1)= VVINDX(J,K,1) + COSA
C      COS1(2)= VVINDX(J,K,2)
C      COS1(3)= VVINDX(J,K,3) - SIN
C
C      I = J+1
DO 1220 L=1,3
R(L)= EV(J,K,L)
D(L)= EV(I,K,L)
1220 P(L)= 0.5*( R(L)+D(L) )
YSPN = P(2)
CALL FLAPS(YSPN,XHE,B,COS3)
YSPN = D(2)
CALL FLAPS(YSPN,XHE,D,COS3)
YSPN = P(2)
SUMB = 0.0
DO 1230 L=1,3
COS2(L)= D(L)-R(L)
1230 SUMB = SUMB + COS2(L)**2
SUMB = SQRT(SUMB)
DO 1240 L=1,3
1240 COS2(L) = COS2(L)/SUMB
C
CALL FLAPS(YSPN,XHE,P,COS3)
C
CALL CROSP(COSL,COS2,COS3)
C
ZLIFT= FG(J,K)
C
DO 1250 L=1,3
1250 SUMSL(L)= SUMSL(L) + ZLIFT*COS3(L)
C
XARM= P(1)-XCD4
SPMO= SPMO + ZLIFT*COS3(1)*XARM
C
1260 CONTINUE
C
C      FLAPN(NSPAN) = -2.0*ZLIFT*COS3(3)/EC(J,NCV)
FLAPX(NSPAN) = 2.0*ZLIFT*COS3(1)/EC(J,NCV)
C
C      DO 1270 L=1,3
1270 SUMSL(4)= SUMSL(4) + SUMSL(L)**2
SUMSL(4)= SQRT(SUMSL(4))
DO 1280 L=1,3
1280 SUMSL(L)= SUMSL(L)/SUMSL(4)
SUMSL(4)= 2.0*SUMSL(4)/CW
C
C      YSPAN(NSPAN)= YSPN/BOTU
SLIFT(NSPAN)= SUMSL(4)*(SUMSL(3)*COSA + SUMSL(1)*SINA)
SDRAG(NSPAN)= SUMSL(4)*(SUMSL(1)*COSA - SUMSL(3)*SINA)
CMOMT(NSPAN)= 2.0*SPMO/XCDR
SCTS= -SUMSL(4)*SUMSL(1)
IF (SCTS) 1290,1290,1300
1290 SCT5= 0.0
1300 SNFC= COSLE*SCTS
IF (SUMSL(3)) 1310,1320,1320
1310 SNFC= -SNFC
1320 CONTINUE
SCLV(NSPAN)= -SNFC*COSA - SCTS*SINA
SCDV(NSPAN)= SCTS*COSA - SNFC*SINA
SPMV(NSPAN)= SNFC*(XLE-XCD4)/CW
C
C
1330 CONTINUE
C
C      LINES= LINES+3
IF (LTNE(X-LINES)) 1340,1350,1350
1340 CALL PAGE
LINES= LINES+3
GO TO 1360
1350 WRITE (IKOUT,1010)
1360 CONTINUE
C
C
CALL CURFIT(YSPAN, SLIFT, ALIFT, NSPAN, ZERO1, ZERO2, N2, N2)
CALL CURFIT(YSPAN, SDRAG, ADRAG, NSPAN, ZERO1, ZERO2, N2, N2)
CALL CURFIT(YSPAN, CMOMT, AMOMT, NSPAN, ZERO1, ZERO2, N2, N2)
CALL CURFIT(YSPAN, AFLPN, NSPAN, ZERO1, ZERO2, N2, N2)
CALL CURFIT(YSPAN, AFLPX, NSPAN, ZERO1, ZERO2, N2, N2)
CALL CURFIT(YSPAN, SCLV, ACLV, NSPAN, ZERO1, ZERO2, N2, N2)
CALL CURFIT(YSPAN, SCDV, ACDV, NSPAN, ZERO1, ZERO2, N2, N2)
CALL CURFIT(YSPAN, SPMV, APMV, NSPAN, ZERO1, ZERO2, N2, N2)
C
C
DELTAB= 2.0/30.0
YSPANO= -1.0
IF (IFLG(1)-1) 1370,1380,1380
1370 DELTAB= 1.0/30.0
YSPANO= 0.0
1380 CONTINUE

```

```

C      DO 1410 J=1,31
C      YPA= DELTAB*FLOAT(J-1) + YSPAN0
C      YSPN= Y08*B0TU
C
C      CL = 0.0
C      CD = 0.0
C      CM = 0.0
C      CLV = 0.0
C      CDV = 0.0
C      CPV = 0.0
C      FCN = 0.0
C      FCX = 0.0
C
C      TEST= ABS(Y08) - 0.999
C      IF (TEST) 1390,1400,1400
1390 CONTINUE
C
C      CALL CURVE(YSPLAN,SLIFT,ALIFT, Y08,CL, DUMYK,NSPAN,N1)
C      CALL CURVE(YSPLAN,SDRAG,AORAG, Y08,CD, DUMYK,NSPAN,N1)
C      CALL CURVE(YSPLAN,CMOMT,AMOMT, Y08,CM, DUMYK,NSPAN,N1)
C      CALL CURVE(YSPLAN,FLAPN,AFLPN, Y08,FCN,DUMYK,NSPAN,N1)
C      CALL CURVE(YSPLAN,FLAPX,AFLPX, Y08,FCX,DUMYK,NSPAN,N1)
C      CALL CURVE(YSPLAN,SCLV, ACLV, Y08,CLV,DUMYK,NSPAN,N1)
C      CALL CURVE(YSPLAN,SCDV, ACDV, Y08,CDV,DUMYK,NSPAN,N1)
C      CALL CURVE(YSPLAN,SPMV, APMV, YCB,CPV,DUMYK,NSPAN,N1)
C
C      1400 CONTINUE
C
C
C      RGLINCLC,J) = CL
C      RCDINCLC,J) = CD
C      RCMINCLC,J) = CM
C      RCLVINCLC,J)= CLV
C      RCDVINCLC,J)= CDV
C      RPNVINCLC,J)= CPV
C      RCFLINCLC,J)= FCN*COSA - FCX*SINA
C      RCFDINCLC,J)= FCX*COSA + FCY*SINA
C      RYSPAN(J) = Y08
C
C      1410 CONTINUE
C
C      1420 CONTINUE
C
C      DELCL= EXECK(2)-WCL
C      EXECK(15)= 0.0
C      SCL1= WCL**2
C      SCL2= SCL1 - EXECK(2)**2
C      WCLVS(2)= ( WCLVS(1) - WCLVS(2) )/SCL2
C      WCLVS(1)= WCLVS(1) - WCLVS(2)*SCL1
C      WCDVS(2)= ( WCDVS(1) - WCDVS(2) )/SCL2
C      WCDVS(1)= WCDVS(1) - WCDVS(2)*SCL1
C      WCPVS(2)= ( WCPVS(1) - WCPVS(2) )/SCL2
C      WCPVS(1)= WCPVS(1) - WCPVS(2)*SCL1
C      WCPDS(2)= ( WCPDS(1) - WCPDS(2) )/DELCL
C      WCPDS(1)= WCPDS(1) - WCPDS(2)*WCL
C      WCDIS(2)= ( WCDIS(1) - WCDIS(2) )/SCL2
C      WCDIS(1)= 0.0
C
C      DO 1460 J=1,31
C      CFNS = RCFL(1,J)**2
C
C      TEST = CFNS - RCFL(2,J)**2
C      ATEST= ABS(TEST)-0.001
C      IF (ATEST) 1430,1430,1440
1430 RCFD(2,J)= 0.0
GO TO 1450
1440 RCFD(2,J)= (RCFD(1,J)-RCFD(2,J))/TEST
1450 RCFD(1,J)= RCFD(1,J) - RCFD(2,J)*CFNS
RCFL(2,J)= (RCFL(2,J)-RCFL(1,J))/DELCL
RCFL(1,J)= RCFL(1,J)-RCFL(2,J)*WCL
RCM(2,J)= (RCM(2,J)-RCM(1,J))/DELCL
RCM(1,J)= RCM(1,J) - RCM(2,J)*WCL
C
SCL1= WCL**2
SCL2= SCL1-EXECK(2)**2
RCLV(2,J)= (RCLV(1,J)-RCLV(2,J))/SCL2
RCLV(1,J)= RCLV(1,J)-RCLV(2,J)*SCL1
RCDV(2,J)= (RCDV(1,J)-RCDV(2,J))/SCL2
RCDV(1,J)= RCDV(1,J)-RCDV(2,J)*SCL1
RPMV(2,J)= (RPMV(1,J)-RPMV(2,J))/SCL2
RPMV(1,J)= RPMV(1,J)-RPMV(2,J)*SCL1
C
SCL1= RCL(1,J)**2
SCL2= SCL1 - RCL(2,J)**2
RCD(2,J)= (RCD(1,J) - RCD(2,J) )/SCL2
RCD(1,J)= RCD(1,J) - RCD(2,J)*SCL1
CLA1(J)= (RCL(2,J)-RCL(1,J))/DELCL
1460 GLB(J) = RCL(1,J) - CLA1(J)*WCL
C
WLIFTS= DELCL/DELALF
WPMOSL= (EXECK(3)-WPM0)/DELALF
WRMOSL= (EXECK(4)-WRM0)/DELALF
WYMOSEL= (EXECK(5)-WYMO)/DELALF
C
ALFA = ALFA - DELALF
ALFARO= ALFA - WCL/WLIFTS
C
LINES= LINES+10

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      IF (LINEX-LINES) 1470,1480,1480          B06 3950   6066
1470 CALL PAGE                                B06 3960   6067
      LINES= LINES+10                            B06 3970   6068
1480 WRITE (KOUT,1020)ALFA,ALFARD,WCL,WLIFTS,WPMOSL,WRMOSL,WYHOSL  B06 3980   6069
C
      DO 1540 J=1,31                           B06 3990   6070
      IF (J-1) 1490,1490,1520                   B06 4000   6071
1490 LINES= LINES+ 2                          B06 4010   6072
      IF (LINEX-LINES) 1500,1510,1510                   B06 4020   6073
1500 CALL PAGE                                B06 4030   6074
      LINES= LINES+2                          B06 4040   6075
1510 WRITE (KOUT,1030)                        B06 4050   6076
1520 LINES= LINES+1                          B06 4060   6077
      IF (LINEX-LINES) 1500,1530,1530                   B06 4070   6078
1530 CONTINUE                               B06 4080   6079
      YSPN= RYSPAN(J)*BOTU                    B06 4090   6080
      WRITE (KOUT,1040)YSPN,RYSPAN(J),CLAI(J),CLB(J),RCL(1,J),RCM(1,J)  B06 4110   6081
1540 CONTINUE                               B06 4120   6082
C
      * LINEARIZED SOLUTION ARRAY *
C
      IF (WINGCL(1)=11) 1550,1570,1570          B06 4130   6083
1550 CONTINUE                               B06 4140   6084
      DO 1560 N=2,NJOBBL                     B06 4150   6085
      M= N-1
1560 WINGCL(N)= WLIFTS*( ALFAL(M)-ALFARD)  B06 4160   6086
1570 CONTINUE                               B06 4170   6087
      SLOPE0 = 0.5/PIE                         B06 4180   6088
      SLOPEW = 1.0/(WLIFTS*RAD)
      IRECN= 0
      TWORD=10
C
      DO 1830 N=2,NJOBBL                     B06 4190   6089
C
      WCL= WINGCL(1)
      ALFA= WCL/WLIFTS + ALFARD
      SIGNL= 1.0
      IF (WCL) 1580,1590,1590
1580 SIGNL= -1.0
1590 CONTINUE                               B06 4200   6090
      IRECN= IRECN +1
C
      LINES= LINES + LINEX
      IF (LINEX-LTNEST) 1600,1610,1610
1600 CALL PAGE                                B06 4210   6091
      LINES= LINES +10
1610 WRITE (KOUT,1020)ALFA,ALFARD,WCL,WLIFTS,WPMOSL,WRMOSL,WYHOSL  B06 4220   6092
C
      DO 1770 J=1,31                           B06 4230   6093
C
      YSPN= RYSPAN(J)*BOTU                    B06 4240   6094
      RCL(1,J)= CLAI(J)*WCL + CLB(J)
C
      CALL CHORDT(YSPN,XLE,XCO4,XTE,XHE,CW,CF)
C
      SCL1= RCL(1,J)**2
      SCL2= WCL**2
      RCL(2,J)= RCO(1,J) + RCD(2,J)*SCL1
      IF (LDrag=1) 1640,1620,1620
1620 RCL(2,J)= 0.0
      IF (CLAI(J)) 1640,1640,1630
1630 RCL(2,J)= (SLOPEW/CLAI(J))-SLOPE0*SCL1
1640 CMAC= RCM(1,J) + RCM(2,J)*WCL
C
      CLV = ( RCLV(1,J) + RCLV(2,J)*SCL2 )*SIGNL + RCL(1,J)
      CPV = ( RPMV(1,J) + RPMV(2,J)*SCL2 )*SIGNL + CMAC
      CDV = ( RCDV(1,J) + RCDV(2,J)*SCL2 ) + RCL(2,J)
      CMLFT= (WINGD(11)-XCO4)*(RCL(1,J)*COSA + RCL(2,J)*SINA)
      FCN = RCFL(1,J) + RCFL(2,J)*WCL
      FCX = FCFL(1,J) + RCFL(2,J)*(FCN**2)
      CFNS= FCN*COSA + FCX*SINA
      FCX = FCX*COSA - FCN*SINA
      FCN = CFNS
      FCN = -FCN/4.0
C
      IF (J-1) 1650,1650,1680
1650 LINES= LINES + 4
      IF (LINEX-LINES) 1660,1660,1670
1660 CALL PAGE                                B06 4450   6116
      LINES= LINES + 4
1670 WRITE (KOUT,1050)                        B06 4460   6117
1680 LINES= LINES + 1
      IF (LINEX-LINES) 1660,1690,1690
1690 CONTINUE                               B06 4470   6118
C
      NOFLPX= NOFLAP + AOAILR
      IF (NOFLPX) 1700,1700,1710
1700 WRITE (KOUT,1060)YSPN,RYSPAN(J),RCL(1,J),RCL(2,J),CMAC,CLV,CDV,CPV  B06 4480   6119
      GO TO 1720
1710 WRITE (KOUT,1060)YSPN,RYSPAN(J),RCL(1,J),RCL(2,J),CMAC,CLV,CDV,CPV  B06 4490   6120
      1,FCN,FCX,FCM
1720 CONTINUE                               B06 4500   6121
C
      IF (J-1) 1730,1730,1740
1730 CONTINUE                               B06 4510   6122
      SUMS= 0.0
      SUMC= 0.0
      SUML= 0.0
      SUMD= 0.0
      SUMP= 0.0
      GO TO 1750
1740 DELTAS= 0.25*(YSPN-YSPNP)*(CW+CWF)    B06 4520   6123
                                                B06 4530   6124
                                                B06 4540   6125
                                                B06 4550   6126
                                                B06 4560   6127
                                                B06 4570   6128
                                                B06 4580   6129
                                                B06 4590   6130
                                                B06 4600   6131
                                                B06 4610   6132
                                                B06 4620   6133
                                                B06 4630   6134
                                                B06 4640   6135
                                                B06 4650   6136
                                                B06 4660   6137
                                                B06 4670   6138
                                                B06 4680   6139
                                                B06 4690   6140
                                                B06 4700   6141
                                                B06 4710   6142
                                                B06 4720   6143
                                                B06 4730   6144
                                                B06 4740   6145
                                                B06 4750   6146
                                                B06 4760   6147
                                                B06 4770   6148
                                                B06 4780   6149
                                                B06 4790   6150
                                                B06 4800   6151
                                                B06 4810   6152
                                                B06 4820   6153
                                                B06 4830   6154
                                                B06 4840   6155
                                                B06 4850   6156
1750 WRITE (KOUT,1060)YSPN,RYSPAN(J),RCL(1,J),RCL(2,J),CMAC,CLV,CDV,CPV  B06 4860   6157
                                                B06 4870   6158
1760 WRITE (KOUT,1060)YSPN,RYSPAN(J),RCL(1,J),RCL(2,J),CMAC,CLV,CDV,CPV  B06 4880   6159
      1,FCN,FCX,FCM
1770 CONTINUE                               B06 4890   6160
C
      IF (J-1) 1780,1780,1790
1780 CONTINUE                               B06 4900   6161
                                                B06 4910   6162
                                                B06 4920   6163
                                                B06 4930   6164
                                                B06 4940   6165
                                                B06 4950   6166
                                                B06 4960   6167
                                                B06 4970   6168
                                                B06 4980   6169
                                                B06 4990   6170
1790 CONTINUE                               B06 5000   6171

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SUMS= SUMS + Z_0*DELTAS          806 5010      6172
SUMC= SUMC + DELTAS*(CW*CWF)     806 5020      6173
SUML= SUML + DELTAS*(RCL(1,J)+RCL11) 806 5030      6174
SUMD= SUMD + DELTAS*(RCL(2,J)+RCL2) 806 5040      6175
SUMP= SUMP + DELTAS*(RCM(1,J)+CWF*RCL+CMFLT+CMFLT1) 806 5050      6176
1750 CONTINUE
C
CWF= CW
YSPNP= YSPN
RCL1= RCL(1,J)
RCL2= RCL(2,J)
RCM1= RCM(1,J)
CMFLT1= CMFLT
C
IF (IFLG(14)-1) 1770,1760
1760 WRITE(KT2)IRECN,IWORD,RYSPAN(J),RCL(1,J),RCL(2,J),CMAC,
1 FCN,FCX,FCM, CLV,CDV,CPV
1770 CONTINUE
C
C
WCD= SUMD/SUMS
WCMAC= WCPDS(1) + WCPDS(2)*WCL
WLOD= WCL/WCD
C
SCL2 = WCL**2
WCLV = ( WCLVS(1) + WCLVS(2)*SCL2 )*SIGNL + WCL
WPMV = ( WCPVS(1) + WCPVS(2)*SCL2 )*SIGNL + WCMAC
WCDV = ( WCDVS(1) + WCDVS(2)*SCL2 )           + WCD
WLODV= WCLV/WCDV
C
IF (N-4) 1780,17EC,1800
1780 M=N-1
WC03(M)= WCD
WCL3(M)= WCL
WCL4(M)= WCL**2
C
IF (N-4) 1800,175C,1800
1790 WCD3(3) = ( WCD3(2) - WCD3(3) )/( WCL3(2) - WCL3(3) )
WCD3(2) = ( WCD3(1) - WCD3(2) )/( WCL3(1) - WCL3(2) )
WCL3(3) = ( WCL4(2) - WCL4(3) )/( WCL3(2) - WCL3(3) )
WCL3(2) = ( WCL4(1) - WCL4(2) )/( WCL3(1) - WCL3(2) )
WCDIS(2)= ( WCD3(2)-WCD3(3) )/( WCL3(2) - WCL3(3) )
WCDIS(1)= WCD3(1) - WCDIS(2)*WCL3(2)
SKINF= SKINF + WCD3(1) - WCDIS(1)*WCL3(1) - WCDIS(2)*WCL4(1)
1800 CONTINUE
C
LINES= LINES+3
IF (LINEX-LINES) 1810,1820,1820
1810 CALL PAGE
LINES= LINES+3
1820 WRITE(KDOUT,1070)WCL,WCD,WC MAC,WLOD,WCLV,WCDV,WPMV,WLODV
C
1830 CONTINUE
C
CALL PAGE
WRITE(KDOUT,1080)
KALFA= IFIX( ALFARO - 2.0 )
LINES= LINES + 9
IRECN= IRECN + 1
IWORD= 7
C
NIMAX= 20.0 -ALFARO
00 1870 N=1,NIMAX
ALFA= FLOAT( N + KALFA )
WCL = WLIFTS*( ALFA-ALFARO )
SCL2 = WCL**2
WCD = SKINF + WCDIS(1)*WCL + WCDIS(2)*SCL2
WC MAC= WCPDS(1) + WCPDS(2)*WCL
WCLV = WCLVS(1) + WCLVS(2)*SCL2
WCDV = WCDVS(1) + WCDVS(2)*SCL2
WPMV = WCPVS(1) + WCPVS(2)*SCL2
C
IF (WCL) 1840,1E50,1B50
1840 WCLV = WCLVS(1) + WCLVS(1) - WCLV
WPMV = WCPVS(1) + WCPVS(1) - WPMV
1850 WCLV = WCLV + WCL
WCDV = WCDV + WCD
WPMV = WPMV + WC MAC
C
'WRITE(KDOUT,1090)ALFA,WCL,WCD,WC MAC,WCLV,WCDV,WPMV
C
IF (IFLG(14)-1) 1E70,1860,1860
1860 CONTINUE
WRITE(KT2)IPECN,IWORD,ALFA,WCL,WCD,WC MAC,WCLV,WCDV,WPMV
1870 CONTINUE
C
IF (IFLG(14)-1) 1890,1880,1880
1880 LINES= LINES + 2
IFLG(15)= IFLG(15) + 1
END FILE KT2
WRITE(KDOUT,1100)IFLG(15)
1890 CONTINUE
C
C
1900 RETURN
C
XXXXXX
C
END

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    V FOR 807,807          807  10      6273
    C                      807  20      6274

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C                                807   30      6275
C                                807   40      6276
C SUBROUTINE SPAN1(IFLAG,NSPS,NDIS,SPAN, YSPAN)    807   50      6277
C                                * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 * 807   60      6279
C                                * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 * 807   80      6280
C                                XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 807 100      6281
C                                XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 807 110      6282
C                                DIMENSION YSPAN(42)          807 120      6283
C COMMON/DATA02/IFLG15), ,EXECK(15), ,RAD, ,PIE          807 130      6284
C COMMON/DATA04/YFLAP1,YFLAP2,FLAPC          807 140      6285
C          * ,YALRN,AISLRNC,MSMOTH          807 150      6286
C          XXXXXXXXXXXXXXXXXX 807 160      6287
C          XXXXXXXXXXXXXXXXXX 807 170      6288
C          XXXXXXXXXXXXXXXXXX 807 180      6289
C          XXXXXXXXXXXXXXXXXX 807 190      6290
C          XXXXXXXXXXXXXXXXXX 807 200      6291
C          IF (IFLAG-1) 100C,1020,1250          807 210      6292
C          * FIXED SPACING *
C          1000 CONTINUE          807 220      6293
C          DELTA= SPAN/FLOAT(NSPS-1)          807 230      6294
C          BOTU= SPAN/2.0 + DELTA          807 240      6295
C          DO 1010 K=1,NSPS          807 250      6296
C          1010 YSPAN(K)=BOTU + DELTA*FLOAT(K)          807 260      6297
C          RETURN          807 270      6298
C          XXXXXX          807 280      6299
C          * VARIABLE SPACING *
C          1020 CONTINUE          807 290      6300
C          PHI= PIE*( 1.0 + FLOAT(NDIS) )          807 300      6301
C          DP PHI= PHI/FLOAT(NSPS-1)          807 310      6302
C          ROTU= SPAN/2.0          807 320      6303
C          DBO = 0.5*SPAN/FLOAT(NDIS+1)          807 330      6304
C          PIFF= PIE
C          PIEM= 1.0
C          DO 1040 N=1,NSPS          807 340      6305
C          PHI= OPHI*FLOAT(N-1)
C          IF (PHI-PIEF) 1040,104D,1030
C          1030 PIELF= PIE + PIFF
C          PIEM= PIEM + 2.0
C          1040 YSPAN(N)= -ROTU + DBO*(PIEM - COS(PHI+PIE-PIEF))
C          IF (YFLAP2) 1250,1250,1050
C          1050 YF1= YFLAP1
C          YF2= YFLAP2
C          TEST= YFLAP1-1.0
C          IF (TEST) 1060,1060,1070
C          1060 YF1= YF1*BOTU
C          YF2= YF2*BOTU
C          1070 CONTINUE
C          IF (NDIS-1) 1250,1250,1080
C          1080 IF (NDIS-3) 1090,1090,1150
C          1090 Y1 = DBO*FLOAT(NDIS-1)
C          * NDIS=2 OR 3 *
C          RAT1= YF2/Y1
C          RAT2= (BOTU-YF2)/(BOTU-Y1)
C          DO 1140 N=1,NSPS
C          T1 = YSPAN(N) + Y1
C          T2 = YSPAN(N) - Y1
C          IF (T1) 1100,1100,1110
C          1100 YSPAN(N)= -YF2 + (YSpan(N)+Y1)*RAT2
C          GO TO 1140
C          1110 IF (T2) 1120,1120,1130
C          1120 YSPAN(N)= YSPAN(N)*RAT1
C          GO TO 1140
C          1130 YSPAN(N)= YF2 + (YSpan(N)-Y1)*RAT2
C          1140 CONTINUE
C          GO TO 1250
C          * NDIS= 4 *
C          1150 Y1= DBO
C          Y2= 3.0*Y1
C          RATO = YF1/Y1
C          RAT1 = (YF2-YF1)/(Y2-Y1)
C          RAT2 = (BOTU-YF2)/(BOTU-Y2)
C          DO 1240 N=1,NSPS
C          T1 = YSPAN(N) + Y2
C          T2 = YSPAN(N) + Y1
C          T3 = YSPAN(N) - Y1
C          T4 = YSPAN(N) - Y2
C          IF (T1) 1160,1160,1170
C          1160 YSPAN(N)= -YF2 + (YSpan(N)+Y2)*RAT2
C          GO TO 1240
C          1170 IF (T2) 1180,1180,1190

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1130 ALD = ALD*DX(2)
1140 IF (TST21) 1150,1150,1160
1150 ALD = D_0
GO TO 1210
1160 IF (TST22) 1170,1180,1180
1170 ALD = 0.5*ALD*(1.0 + SIN(PIE*(TST21/DELT2 - 0.5)))
GO TO 1210
1180 IF (TST31) 1210,1190,1190
1190 IF (TST32) 1200,1150,1150
1200 ALD= 0.5*ALD*(1.0 + SIN(PIE*(TST31/DELT2+0.5)))
1210 TAND = TAN( (ALD+FLAPD)/RAD)
C
C      COSD= 1.0/SQRT( 1.0 + TAND**2 )
SIND = TAND*COSD
C
COSF(1) = COSX*COSD - COSZ*SIND
COSF(3) = COSZ*COSD + COSX*SIND
C
IF (LFLAP-1) 1220,1230,1230
1220 P(1) = P(1) - DELTX*(1.0-COSD)
P(3) = P(3) + DELTX*SIND
1230 CONTINUE
C
RETURN
C      XXXXXX
C
C      END
B10   660    6584
B10   670    6585
B10   680    6586
B10   690    6587
B10   700    6588
B10   710    6589
B10   720    6590
B10   730    6591
B10   740    6592
B10   750    6593
B10   760    6594
B10   770    6595
B10   780    6596
B10   790    6597
B10   800    6598
B10   810    6599
B10   820    6600
B10   830    6601
B10   840    6602
B10   850    6603
B10   860    6604
B10   870    6605
B10   880    6606
B10   890    6607
B10   900    6608
B10   910    6609
B10   920    6610
B10   930    6611
B10   940    6612

B11   10     6613
B11   20     6614
B11   30     6615
B11   40     6616
B11   50     6617
B11   60     6618
B11   70     6619
B11   80     6620
B11   90     6621
B11  100    6622
B11  110    6623
B11  120    6624
B11  130    6625
B11  140    6626
B11  150    6627
B11  160    6628
B11  170    6629
B11  180    6630
B11  190    6631
B11  200    6632
B11  210    6633
B11  220    6634
B11  230    6635
B11  240    6636
B11  250    6637
B11  260    6638
B11  270    6639
B11  280    6640
B11  290    6641
B11  300    6642
B11  310    6643
B11  320    6644
B11  330    6645
B11  340    6646
B11  350    6647
B11  360    6648
B11  370    6649
B11  380    6650
B11  390    6651
B11  400    6652
B11  410    6653
B11  420    6654
B11  430    6655
B11  440    6656
B11  450    6657
B11  460    6658
B11  470    6659
B11  480    6660
B11  490    6661
B11  500    6662
B11  510    6663
B11  520    6664
B11  530    6665
B11  540    6666
B11  550    6667
B11  560    6668
B11  570    6669
B11  580    6670
B11  590    6671
B11  600    6672
B11  610    6673
B11  620    6674
B11  630    6675
B11  640    6676
B11  650    6677
B11  660    6678
B11  670    6679
B11  680    6680
B11  690    6681
B11  700    6682
B11  710    6683
B11  720    6684
B11  730    6685
B11  740    6686

V FOR B11,B11
C
C      SUBROUTINE VORTEX(P,B,D,TANA,GAMA,    VI,VCOSI)
C
C      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *B11 70
C      * PROGRAM DEVELOPED BY A. V. GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *B11 80
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXB11 100
C
C      DIMENSION P(3),B(3),D(3)
DIMENSION COS1(3),COS2(3),COS3(3), X(3),A(3),VCOS(3)
DIMENSION G(3)
C
COMMON/DATA01/KIN1 ,KOUT1 ,KT1 ,KT2 ,LINE1 ,LINES
COMMON/DATA02/IFLG(15) ,EXCK(15) ,RAD ,PIE
COMMON/DATA07/LFLAP,LDRAG,CUTDF1,CUTDF2
C
NAMELIST/DBUGV1/P,B,D,TANA,GAMA,PSIF,VCOS
NAMELIST/DBUGV2/PSIF,VCOS
NAMELIST/DBUGV3/PSIF,VCOS
C
1000 FORMAT(1X,/,1X)
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXB11 260
C
C
C      NOTE= TFLG(10)-8
TANAS= TANA**2
COSA= 1.0 - TANAS/2.0
IF (TANAS-0.00011 1020,1010,1010
1010 COSA= 1.0/SQRT(TANAS+1.0)
1020 SINA= COSA*TANA
C
SCALE= SQRT((D(1)-B(1))**2+(D(2)-B(2))**2+(D(3)-B(3))**2)
DO 1030 K=1,3
X(K)= (P(K)-0.5*(B(K)+D(K)))/SCALE
A(K)= (0.5*(D(K)-B(K)))/SCALE
1030 VCOS(K)= 0.0
C
C      * SEGMENT INF-A-B *
C
H5 = TANA*( X(1)+ A(1))
C
HS1 = (X(1)+A(1))**2 + H5**2
HS2 = (X(2)+A(2))**2 + (X(3)+A(3)-H5)**2
HS3 = (X(1)+A(1))**2 + (X(2)+A(2))**2 + (X(3)+A(3))**2
H1 = SQRT(HS1)
H2 = SQRT(HS2)
C
COSG= 0.0
SING= 1.0
TEST = CUTDF1 - H1
C
IF (TEST) 1040,1050,1050
1040 COSG= (HS3-HS1-HS2)/(2.0*H1*HZ)
STNG= SQRT(ABS(1.0-COSG**2))
1050 CONTINUE
C
R = H2*SING
H4 = H2*COSG
SH14= H1+H4
C
PSIF= ( 1.0 +SH14/SQRT(SH14**2+R**2) )/R
C
COS1(1) = COSA
COS1(2) = 0.0
COS1(3) = SINA
COS2(1) = ( X(1)+A(1)-SH14*COSA )/R
COS2(2) = ( X(2)+A(2) )/R

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      COS2(3) = ( X(3)+A(3)-SH14*SINA )/R          B11  750   6687
C      CALL CROSP( COS1,COS2,COS3)                  B11  760   6688
C      DO 1060 K=1,3                                B11  770   6689
1060 VCOS(K)= PSIF*COS3(K)                      B11  780   6690
C      IF (NOTE) 1080,1C70,1C70
1070 WRITE (KDUT,1000)
      WRITE (KDUT,DBUGV1)
1080 CONTINUE
C
C      * SEGMENT D-E-INF *
C      H5 = TANA*(X(1)-A(1))
C      HS1 = (X(1)-A(1))**2 + H5**2
HS2 = (X(2)-A(2))**2 + (X(3)-A(3)-H5)**2
HS3 = (X(1)-A(1))**2 + (X(2)-A(2))**2 + (X(3)-A(3))**2
H1 = SQRT(HS1)
H2 = SQRT(HS2)
C      COSG= 0.0
SING= 1.0
TEST = CUTOFL - H1
C      IF (TEST) 1090,1100,1100
1090 COSG= (HS3-HS1-HS2)/(2.0*H1*H2)
SING= SQRT(ABS(1.0-COSG**2))
1100 CONTINUE
C      R = H2*SING
H4 = H2*COSG
SH14= H1+H4
C      PSIF= (-1.0 -SH14/SQRT(SH14**2+R**2) )/R
C      COS1(1)= COSA
COS1(2)= 0.0
COS1(3)= SINA
COS2(1)= ( X(1)-A(1)-SH14*COSA )/R
COS2(2)= ( X(2)-A(2) )/R
COS2(3)= ( X(3)-A(3)-SH14*SINA )/R
C      CALL CROSP(COS1,CCS2,COS3)
C      DO 1110 K=1,3
1110 VCOS(K)= VCOS(K) + PSIF*COS3(K)
C      IF (NOTE) 1130,1120,1120
1120 WRITE (KDUT,DBUGV1)
1130 CONTINUE
C
C      * SEGMENT B-C-D *
C      HS1 = 4.0*( A(1)**2 + A(2)**2 + A(3)**2 )
HS2 = (X(1)-A(1))**2 + (X(2)-A(2))**2 + (X(3)-A(3))**2
HS3 = (X(1)-A(1))**2 + (X(2)+A(2))**2 + (X(3)+A(3))**2
H1 = SQRT(HS1)
H2 = SQRT(HS2)
C      COSG= (HS3-HS1-HS2)/(2.0*H1*H2)
SING= SQRT(ABS(1.0-COSG**2))
PSIF= 0.0
TEST = ABS(SING) - CUTOFL
C      IF (TEST) 1170,1170,1140
1140 CONTINUE
C      R = H2*SING
C      TEST = R/H1 - 10.0*CUTOFL
      IF (TEST) 1170,1170,1150
1150 CONTINUE
C      RS = R**2
H4 = H2*COSG
SH14= H1+H4
T1= 1.0 + 2.0*H4/H1
C      PSIF= (SH14/SQRT(SH14**2+RS) -H4/SQRT(H4**2+RS))/R
C      DO 1160 K=1,3
G(K)= A(K)*T1
COS1(K)= (G(K)-X(K))/R
1160 COS2(K)= -2.0*A(K)/H1
C      CALL CROSP(COS1,COS2,COS3)
C      1170 CONTINUE
C      V2= 0.0
C      DO 1180 K=1,3
VCOS(K)= VCOS(K) + PSIF*COS3(K)
1180 V2= V2 + VCOS(K)**2
C      IF (NOTE) 1200,1150,1190
1190 WRITE (KDUT,DBUGV1)
      LINES= LINEX - 10
1200 CONTINUE
C
      B11  750   6687
      B11  760   6688
      B11  770   6689
      B11  780   6690
      B11  790   6691
      B11  800   6692
      B11  810   6693
      B11  820   6694
      B11  830   6695
      B11  840   6696
      B11  850   6697
      B11  860   6698
      B11  870   6699
      B11  880   6700
      B11  890   6701
      B11  900   6702
      B11  910   6703
      B11  920   6704
      B11  930   6705
      B11  940   6706
      B11  950   6707
      B11  960   6708
      B11  970   6709
      B11  980   6710
      B11  990   6711
      B11 1000   6712
      B11 1010   6713
      B11 1020   6714
      B11 1030   6715
      B11 1040   6716
      B11 1050   6717
      B11 1060   6718
      B11 1070   6719
      B11 1080   6720
      B11 1090   6721
      B11 1100   6722
      B11 1110   6723
      B11 1120   6724
      B11 1130   6725
      B11 1140   6726
      B11 1150   6727
      B11 1160   6728
      B11 1170   6729
      B11 1180   6730
      B11 1190   6731
      B11 1200   6732
      B11 1210   6733
      B11 1220   6734
      B11 1230   6735
      B11 1240   6736
      B11 1250   6737
      B11 1260   6738
      B11 1270   6739
      B11 1280   6740
      B11 1290   6741
      B11 1300   6742
      B11 1310   6743
      B11 1320   6744
      B11 1330   6745
      B11 1340   6746
      B11 1350   6747
      B11 1360   6748
      B11 1370   6749
      B11 1380   6750
      B11 1390   6751
      B11 1400   6752
      B11 1410   6753
      B11 1420   6754
      B11 1430   6755
      B11 1440   6756
      B11 1450   6757
      B11 1460   6758
      B11 1470   6759
      B11 1480   6760
      B11 1490   6761
      B11 1500   6762
      B11 1510   6763
      B11 1520   6764
      B11 1530   6765
      B11 1540   6766
      B11 1550   6767
      B11 1560   6768
      B11 1570   6769
      B11 1580   6770
      B11 1590   6771
      B11 1600   6772
      B11 1610   6773
      B11 1620   6774
      B11 1630   6775
      B11 1640   6776
      B11 1650   6777
      B11 1660   6778
      B11 1670   6779
      B11 1680   6780
      B11 1690   6781
      B11 1700   6782
      B11 1710   6783
      B11 1720   6784
      B11 1730   6785
      B11 1740   6786
      B11 1750   6787
      B11 1760   6788
      B11 1770   6789
      B11 1780   6790
      B11 1790   6791
      B11 1800   6792

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V1= SQRT(V2)
DO 1210 K=1,3
1210 VCOS(K)= VCOS(K)/V1
C
C     VI= V1*(GAMA/SCALE)
C
C     RETURN
C     XXXXXX
C
C     END
B11 1810      6793
B11 1820      6794
B11 1830      6795
B11 1840      6796
B11 1850      6797
B11 1860      6798
B11 1870      6799
B11 1880      6800
B11 1890      6801
B11 1900      6802

V FOR B12,B12
C
C
C     SUBROUTINE REFLEC(P,ZL,ALFAR,COSR)
C
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *B12 70
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *B12 80
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX B12 100
C
C     DIMENSION P(3)
COMMON/DATA01/KIN ,KOUT ,KT1 ,KT2 ,LINE ,LINES
COMMON/DATA02/IFLG(15) ,EXECK(15) ,RAD ,PIE
NAMELIST/REFLEX/PX,PY,X1,Y1,PHI,ALFAR,RX,RY,ZL,COSR
DATA X2/0.0/, Y2/0.0/
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX B12 110
C
C     IF (NOTE) 1010,1010,1000
1000 WRITE (KOUT,REFLEX)
1010 CONTINUE
C
C     RX=-RX
C
C     CALL ROTATE(RX,RY,X2,Y2,ALFAR,X1,Y1,PX,PY)
C
C     IF (NOTE) 1030,1030,1020
1020 WRITE (KOUT,REFLEX)
      LINES= LINES+24
1030 CONTINUE
C
C     P(3)= PX
C     P(1)= PY
C
C     RETURN
C     XXXXX
C
C     END
B12 120      6803
B12 20       6804
B12 30       6805
B12 40       6806
B12 50       6807
B12 60       6808
B12 70       6809
B12 80       6810
B12 90       6811
B12 100      6812
B12 110      6813
B12 120      6814
B12 130      6815
B12 140      6816
B12 150      6817
B12 160      6818
B12 170      6819
B12 180      6820
B12 190      6821
B12 200      6822
B12 210      6823
B12 220      6824
B12 230      6825
B12 240      6826
B12 250      6827
B12 260      6828
B12 270      6829
B12 280      6830
B12 290      6831
B12 300      6832
B12 310      6833
B12 320      6834
B12 330      6835
B12 340      6836
B12 350      6837
B12 360      6838
B12 370      6839
B12 380      6840
B12 390      6841
B12 400      6842
B12 410      6843
B12 420      6844
B12 430      6845
B12 440      6846
B12 450      6847
B12 460      6848
B12 470      6849
B12 480      6850
B12 490      6851
B12 500      6852

V FOR B13,R13
C
C
C     SUBROUTINE DMATINV(N,DETERM)
C
C     MATRIX INVERSION WITH ACCOMPANYING SOLUTION OF LINEAR EQUATIONS B13 70
C     * VERSION 2 ROUTINE (DOUBLE PRECISION-LANGLEY MATINV SUBROUTINE) *B13 80
C
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *B13 100
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *B13 110
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX B13 120
C
C     DOUBLE PRECISION R1,R2,DETERM,AMAX,T,SWAP,PIVOT,PIVOTI
DOLRF PRECISION IPIVOT(71),A(71,71),B(1,1),INDEX(71,2)
EQUIVALENCE (IRCOL,JROW), (ICOLUMN,JCOLUMN), (AMAX, T, SWAP)
M= 0
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX B13 130
C
C     INIALIZATION
C
1000 ISCALE=D
1010 R1 = 1.E36
1020 R2=1.0/R1
1030 DETERM=L.0
1040 DO 1050 J=1,N
1050 IPIVOT(J)=0
1060 DO 1060 I=1,N
C
C     SEARCH FOR PIVOT ELEMENT
C
1070 AMAX=0.0
1080 DO 1170 J=1,N
1090 IF (IPIVOT(J)-1) 1100,1170,1100
1100 DO 1160 K=1,N
1110 IF (IPIVOT(K)-1) 1120,1160,1750
B13 140      6853
B13 20       6854
B13 30       6855
B13 40       6856
B13 50       6857
B13 60       6858
B13 70       6859
B13 80       6860
B13 90       6861
B13 100      6862
B13 110      6863
B13 120      6864
B13 130      6865
B13 140      6866
B13 150      6867
B13 160      6868
B13 170      6869
B13 180      6870
B13 190      6871
B13 200      6872
B13 210      6873
B13 220      6874
B13 230      6875
B13 240      6876
B13 250      6877
B13 260      6878
B13 270      6879
B13 280      6880
B13 290      6881
B13 300      6882
B13 310      6883
B13 320      6884
B13 330      6885
B13 340      6886
B13 350      6887
B13 360      6888
B13 370      6889
B13 380      6890
B13 390      6891
B13 400      6892

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1120 IF (DABS(AMAX)-DABS(A(J,K))) 1130,1160,1160      B13  410   6893
1130 IROW=J          B13  420   6894
1140 ICOLUMN=K        B13  430   6895
1150 AMAX=A(J,K)      B13  440   6896
1160 CONTINUE          B13  450   6897
1170 CONTINUE          B13  460   6898
    IF (AMAX) 1190,1180,1190      B13  470   6899
1180 DETERM=0.0        B13  480   6900
    ISCALE=0            B13  490   6901
    GO TO 1750          B13  500   6902
C     XXXXXX           B13  510   6903
C
C     1190 IPIVOT(ICOLUMN)=IPIVOT(ICOLUMN)+1           B13  520   6904
C     INTERCHANGE ROWS TO PUT PIVOT ELEMENT ON DIAGONAL B13  530   6905
C
1200 IF (IROW=ICOLUMN) 1210,1310,1210      B13  540   6906
1210 DETERM=DETERM      B13  550   6907
1220 DO 1250 L=1,N      B13  560   6908
1230 SWAP=A(IROW,L)      B13  570   6909
1240 A(IROW,L)=A(ICOLUMN,L)  B13  580   6910
1250 A(ICOLUMN,L)=SWAP      B13  590   6911
C
C     1260 IF (M) 1310,1310,1270           B13  600   6912
1270 DO 1300 L=1,M      B13  610   6913
1280 SWAP=B(IROW,L)      B13  620   6914
1290 B(IROW,L)=B(ICOLUMN,L)  B13  630   6915
1300 B(ICOLUMN,L)=SWAP      B13  640   6916
1310 INDEX{1,1}=IROW       B13  650   6917
1320 INDEX{1,2}=ICOLUMN     B13  660   6918
1330 PIVOT=A(ICOLUMN,ICOLUMN)  B13  670   6919
    IF (PIVOT) 1340,1180,1340      B13  680   6920
C
C     SCALE THE DETERMINANT          B13  690   6921
C
1340 PIVOT=PIVOT        B13  700   6922
1350 IF (DABS(DETERM)=R1) 1380,1360,1360      B13  710   6923
1360 DETERM=DETERM/R1      B13  720   6924
    ISCALE=ISCALE+1          B13  730   6925
    IF (DABS(DETERM)=R1) 1410,1370,1370      B13  740   6926
1370 DETERM=DETERM/R1      B13  750   6927
    ISCALE=ISCALE+1          B13  760   6928
    GO TO 1410          B13  770   6929
1380 IF (DABS(DETERM)=R2) 1390,1390,1410      B13  780   6930
1390 DETERM=DETERM*R1      B13  790   6931
    ISCALE=ISCALE-1          B13  800   6932
    IF (DABS(DETERM)=R2) 1400,1400,1410      B13  810   6933
1400 DETERM=DETERM*R1      B13  820   6934
    ISCALE=ISCALE+1          B13  830   6935
    GO TO 1410          B13  840   6936
1410 IF (DABS(PIVOT)=R1) 1440,1420,1420      B13  850   6937
1420 PIVOT=PIVOT/R1      B13  860   6938
    ISCALE=ISCALE+1          B13  870   6939
    IF (DABS(PIVOT)=R1) 1440,1420,1420      B13  880   6940
1440 PIVOT=PIVOT/R1      B13  890   6941
    ISCALE=ISCALE-1          B13  900   6942
    IF (DABS(PIVOT)=R1) 1440,1420,1420      B13  910   6943
1450 PIVOT=PIVOT/R1      B13  920   6944
    ISCALE=ISCALE-1          B13  930   6945
1460 PIVOT=PIVOT/R1      B13  940   6946
    ISCALE=ISCALE+1          B13  950   6947
1470 PIVOT=PIVOT/R1      B13  960   6948
    ISCALE=ISCALE+1          B13  970   6949
    GO TO 1470          B13  980   6950
1480 A(ICOLUMN,ICOLUMN)=1.0      B13  990   6951
1490 DO 1500 L=1,N      B13 1000   6952
1500 A(ICOLUMN,L)=A(ICOLUMN,L)/PIVOT      B13 1010   6953
C
C     DIVIDE PIVOT ROW BY PIVOT ELEMENT          B13 1020   6954
C
1510 IF (M) 1540,1540,1520      B13 1030   6955
1520 DO 1530 L=1,M      B13 1040   6956
1530 B(ICOLUMN,L)=B(ICOLUMN,L)/PIVOT      B13 1050   6957
C
C     REDUCE NON-PIVOT ROWS          B13 1060   6958
C
1540 DO 1630 L1=1,N      B13 1070   6959
1550 IF (L1-ICOLUMN) 1560,1630,1560      B13 1080   6960
1560 T=A(L1,ICOLUMN)        B13 1090   6961
1570 A(L1,ICOLUMN)=0.0        B13 1100   6962
1580 DO 1590 L=1,N      B13 1110   6963
1590 A(L1,L)=A(L1,L)-A(ICOLUMN,L)*T      B13 1120   6964
C
C     1600 IF (M) 1630,1630,1610      B13 1130   6965
1610 DO 1620 L=1,M      B13 1140   6966
1620 B(L1,L)=B(L1,L)-B(ICOLUMN,L)*T      B13 1150   6967
1630 CONTINUE          B13 1160   6968
C
C     INTERCHANGE COLUMNS          B13 1170   6969
C
1640 DO 1740 I=1,N      B13 1180   6970
1650 L=N+I-1          B13 1190   6971
1660 IF (INDEX(L,1)=INDEX(L,2)) 1670,1740,1670      B13 1200   6972
1670 JROW=INDEX(L,1)        B13 1210   6973
1680 JCOLUMN=INDEX(L,2)      B13 1220   6974
1690 DO 1730 K=1,N      B13 1230   6975
1700 SWAP=A(K,JROW)        B13 1240   6976
1710 A(K,JROW)=A(K,JCOLUMN)  B13 1250   6977
1720 A(K,JCOLUMN)=SWAP      B13 1260   6978
1730 CONTINUE          B13 1270   6979
1740 CONTINUE          B13 1280   6980
1750 RETURN          B13 1290   6981
B13 1300   6982
B13 1310   6983
B13 1320   6984
B13 1330   6985
B13 1340   6986
B13 1350   6987
B13 1360   6988
B13 1370   6989
B13 1380   6990
B13 1390   6991
B13 1400   6992
B13 1410   6993
B13 1420   6994
B13 1430   6995
B13 1440   6996
B13 1450   6997
B13 1460   6998

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C      XXXXXX          B13 1470      6999
C      END              B13 1480      7000
C                                B13 1490      7001

V FOR B14,B14          B14  10      7002
C
C
C      SUBROUTINE DOTP(A,B,C)          B14  20      7003
C
C      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *B14  30      7004
C      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *B14  40      7005
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX B14  50      7006
C
C      DIMENSION A(3),B(3)          B14  60      7007
C      C= A(1)*B(1)+ A(2)*B(2)+ A(3)*B(3)          B14  70      7008
C
C      RETURN          B14  80      7009
C      XXXXXX          B14  90      7010
C
C      END              B14 110      7012
C                                B14 120      7013
C                                B14 130      7014
C                                B14 140      7015
C                                B14 150      7016
C                                B14 160      7017
C                                B14 170      7018
C                                B14 180      7019

V FOR B15,B15          B15  10      7020
C
C
C      SUBROUTINE CROSP( A,B,C)          B15  20      7021
C
C      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *B15  30      7022
C      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *B15  40      7023
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX B15  50      7024
C
C      DIMENSION A(3),B(3),C(3)          B15  60      7025
C
C      C(1)= A(2)*B(3) - A(3)*B(2)          B15  70      7026
C      C(2)= A(3)*B(1) - A(1)*B(3)          B15  80      7027
C      C(3)= A(1)*B(2) - A(2)*B(1)          B15  90      7028
C
C      RETURN          B15 100      7029
C      XXXXXX          B15 110      7030
C
C      END              B15 120      7031
C                                B15 130      7032
C                                B15 140      7033
C                                B15 150      7034
C                                B15 160      7035
C
C      B15 170      7036
C
C      RETURN          B15 180      7037
C      XXXXXX          B15 190      7038
C
C      END              B15 200      7039
C                                B15 210      7040

V FOR B16,B16          B16  10      7041
C
C
C      SUBROUTINE ROTATE( X,Y, X0,Y0, PHI, XF,YF, XT,YT )          B16  20      7042
C
C      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *B16  30      7043
C      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *B16  40      7044
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX B16  50      7045
C
C      XS = X-X0          B16  60      7046
C      YS = Y-Y0          B16  70      7047
C      RHM= SQRT( XS**2 + YS**2 )
C      ERROR= 0.0001
C      TESTX= ABS(XS)-ERROR
C      TESTY= ABS(YS)-ERROR
C      IF (TESTX) 1000,1000,1020
1000 IF (TESTY) 1010,1010,1020
1010 ZET= 0.0
GO TO 1110
1020 ZET= 1.570795*(YS/ABS(YS)) - XS/YS
GO TO 1110
1030 ZET= ABS(YS/XS)
IF (TESTY) 1050,1050,1040
1040 ZET=ATAN(ZET)
1050 CONTINUE
IF (XS) 1070,1050,1060
1060 IF (YS) 1100,1110,1110
1070 IF (YS) 1090,1080,1080
1080 ZET= 3.14159 - ZET
GO TO 1110
1090 ZET= 3.14159 + ZET
GO TO 1110
1100 ZET= 6.28318 - ZET
1110 CONTINUE
ZPP= PHI + ZET
XR = RHO*COS(ZPP)
YR = RHO*SIN(ZPP)
XT= XF + XR
YT= YF + YR
C
RETURN
C      XXXXXX
C
END          B16 110      7051
B16 120      7052
B16 130      7053
B16 140      7054
B16 150      7055
B16 160      7056
B16 170      7057
B16 180      7058
B16 190      7059
B16 200      7060
B16 210      7061
B16 220      7062
B16 230      7063
B16 240      7064
B16 250      7065
B16 260      7066
B16 270      7067
B16 280      7068
B16 290      7069
B16 300      7070
B16 310      7071
B16 320      7072
B16 330      7073
B16 340      7074
B16 350      7075
B16 360      7076
B16 370      7077
B16 380      7078
B16 390      7079
B16 400      7080
B16 410      7081
B16 420      7082
B16 430      7083
B16 440      7084
B16 450      7085
B16 460      7086

V FOR B17,B17          B17  10      7087
C
C
C      SUBROUTINE CURFIT(X,Y,A, N, DY1,DY2, K1,K2)          B17  20      7088
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX B17  30      7089
C
C      B17  40      7090
C
C      B17  50      7091
C
C      B17  60      7092

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C * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG-72 *B17 70 7093
C * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *B17 80 7094
C *                                                       B17 90 7095
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXB17 100 7096
C                                                       B17 110 7097
C DIMENSION X(22),Y(22),A(42),B(42),C(1)  B17 120 7098
C *****  B17 130 7099
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXB17 140 7100
C                                                       B17 150 7101
C FOR THE WHOLE TABULATED TABLE  B17 160 7102
C X(I) = INDEPENDENT VARIABLE.....I=1,N (GIVEN)  B17 170 7103
C Y(I) = DEPENDENT VARIABLE.....I=1,N (GIVEN)  B17 180 7104
C N = LENGTH OF Y-VS-X TABLE (GIVEN)  B17 190 7105
C DY1 = 1ST OR 2ND DERIVATIVE AT LOWER END OF TABLE  B17 200 7106
C DY2 = 1ST OR 2ND DERIVATIVE AT UPPER END OF TABLE  B17 210 7107
C K1 = 1 .....DY1 = 1ST DERIVATIVE (GIVEN)  B17 220 7108
C K1 = 2 .....DY1 = 2ND DERIVATIVE (GIVEN)  B17 230 7109
C K2 = 1 .....DY2 = 1ST DERIVATIVE (GIVEN)  B17 240 7110
C K2 = 2 .....DY2 = 2ND DERIVATIVE (GIVEN)  B17 250 7111
C                                                       B17 260 7112
C                                                       B17 270 7113
C THE DIMENSION C(1) MUST FOLLOWS THE DIMENSION OF B  B17 280 7114
C MINIMUM DIMENSION OF B IS.....[2*N-2]  B17 290 7115
C DIMENSION OF A IS SAME AS B, BUT GIVEN IN MAIN PROGRAM  B17 300 7116
C                                                       B17 310 7117
C                                                       B17 320 7118
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXB17 330 7119
C                                                       B17 340 7120
C                                                       B17 350 7121
C                                                       B17 360 7122
C C(1)=0.0  B17 370 7123
C NRNG= 100
C
C N1 = N-2
C C1 = X(2)-X(1)
C IF (C1) L170,1170,1000
1000 GO TO (1010,1020),K1
1010 R(1) = 0.0
A(1) = (DY1-(Y(2)-Y(1))/C1)/C1
GO TO 1030
1020 B(1) = -C1
A(1) = -DY1/2.0
1030 J = 1
C
IF (N1) 1150,1090,1060
1040 IF (NPNG-N) 1150,1050,1050
C
1050 DO 1060 T=1,N1
K = I+1
J = J+1
C1 = X(K)-X(I)
C2 = X(K+1)-X(K)
C3 = Y(K)-Y(I)
C4 = Y(K+1)-Y(K)
C5 = C3/C1-C4/C2
C6 = C1/C2
C7 = C1*C2
R(J) = 1.0/C6*(C1-B(J-1))
A(J) = (C5/C2-C6*A(J-1))+B(J)
J = J+1
B(J) = 1.0/((-C1-C2)/C7-C6*B(J-1))
A(J) = -C5/C7-C6*A(J-1))*B(J)
1060 CONTINUE
C
GO TO (1070,1080),K2
1070 A(J+1) = (DY2-C4/C2+C2*A(J))/((C2*(B(J)-C2))
GO TO 1120
1080 A(J+1) = (DY2/2.+A(J))/(-2.*C2+B(J))
GO TO 1120
C
C STATEMENTS 42 TO 44 ARE FOR N=2 ONLY
C
1090 C3 = K1
C2 = 1.0/C3
GO TO (1100,1110),K2
1100 A(J+1) = ((Y(2)-Y(1))/C1-A(J)*C1-DY2)/(C1*C1)*C2
GO TO 1120
1110 A(J+1) = C3*((DY2+2.0*A(1))/14.0*C1)
C
1120 J = 2*(N-1)
C
1130 J = J-1
IF (J) 1170,1170,1140
1140 A(J) = A(J)+B(J)*A(J+1)
GO TO 1130
C
C
1150 WRITE (6,1160)N,NRNG
C
CALL EXIT
1160 FFORMAT(4H0N =15,3X9HIN CURFIT/31H .....N MUST BE IN THE RANGE
1 13H BETWEEN 2 AND 15/39H*INCREASE DIMENSION OF B IN CURFIT
2 19H IF N IS TOO LARGE /12H0B = 2*(N-1) )
1170 RETURN
C
C XXXXXX
C
END

V FOR B18,B18
C
C
C
SUBROUTINE CURVE(X,Y,A, XP,YP,DYP,N,IT)

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C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX B20 110    7298
C      DOUBLE PRECISION DELTA,AMAT(71,71),BMAT(71,71),CMAT(71,71)   B20 120    7299
1000 FORMAT(10X,15.2F14.4 )   B20 130    7300
1010 FORMAT( 1X/,1X )        B20 140    7301
1020 FORMAT(10X,5IPE14.6)   B20 150    7302
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX B20 160    7303
C      B20 170    7304
C      B20 180    7305
C      B20 190    7306
C      B20 200    7307
C      B20 210    7308
C      NOR= 5          B20 220    7309
C      B20 230    7310
C      B20 240    7311
C      B20 250    7312
C      B20 260    7313
C      B20 270    7314
C      B20 280    7315
C      AMAT(1,1) = 1.032  B20 290    7316
C      AMAT(1,2) = 7.865  B20 300    7317
C      AMAT(1,3) = 3.216  B20 310    7318
C      AMAT(1,4) = 3.031  B20 320    7319
C      AMAT(1,5) = 10.32  B20 330    7320
C      AMAT(2,1) = 7.68  B20 340    7321
C      AMAT(2,2) = -6.34  B20 350    7322
C      AMAT(2,3) = 8.900  B20 360    7323
C      AMAT(2,4) = -1.02  B20 370    7324
C      AMAT(2,5) = 5.690  B20 380    7325
C      AMAT(3,1) = 3.030  B20 390    7326
C      AMAT(3,2) = -3.38  B20 400    7327
C      AMAT(3,3) = -11.67 B20 410    7328
C      AMAT(3,4) = 4.180  B20 420    7329
C      AMAT(3,5) = -3.60  B20 430    7330
C      AMAT(4,1) = -2.93  B20 440    7331
C      AMAT(4,2) = 5.670  B20 450    7332
C      AMAT(4,3) = 8.323  B20 460    7333
C      AMAT(4,4) = 9.073  B20 470    7334
C      AMAT(4,5) = 0.0378 B20 480    7335
C      AMAT(5,1) = -0.0578 B20 490    7336
C      AMAT(5,2) = 7.102  B20 500    7337
C      AMAT(5,3) = 9.992  B20 510    7338
C      AMAT(5,4) = 0.97E  B20 520    7339
C      AMAT(5,5) = 15.14  B20 530    7340
C      B20 540    7341
C      CALL DMATIN(BMAT,NOR,DELTA)
C      B20 550    7342
C      B20 560    7343
C      B20 570    7344
C      B20 580    7345
C      B20 590    7346
C      B20 600    7347
C      B20 610    7348
C      B20 620    7349
C      B20 630    7350
C      B20 640    7351
C      CALL PAGE
WRITE (6,1020)((AMAT(J,K),J=1,NOR),K=1,NOR) B20 650    7352
WRITE (6,1010)                                     B20 660    7353
WRITE (6,1020)((BMAT(J,K),J=1,NCR),K=1,NOR) B20 670    7354
WRITE (6,1010)                                     B20 680    7355
WRITE (6,1020)((CMAT(J,K),J=1,NCR),K=1,NOR) B20 690    7356
WRITE (6,1010)                                     B20 700    7357
WRITE (6,1010)                                     B20 710    7358
WRITE (6,1020)DELTA                            B20 720    7359
STOP                                              B20 730    7360
END                                              B20 740    7361
                                                 B20 750    7362

```